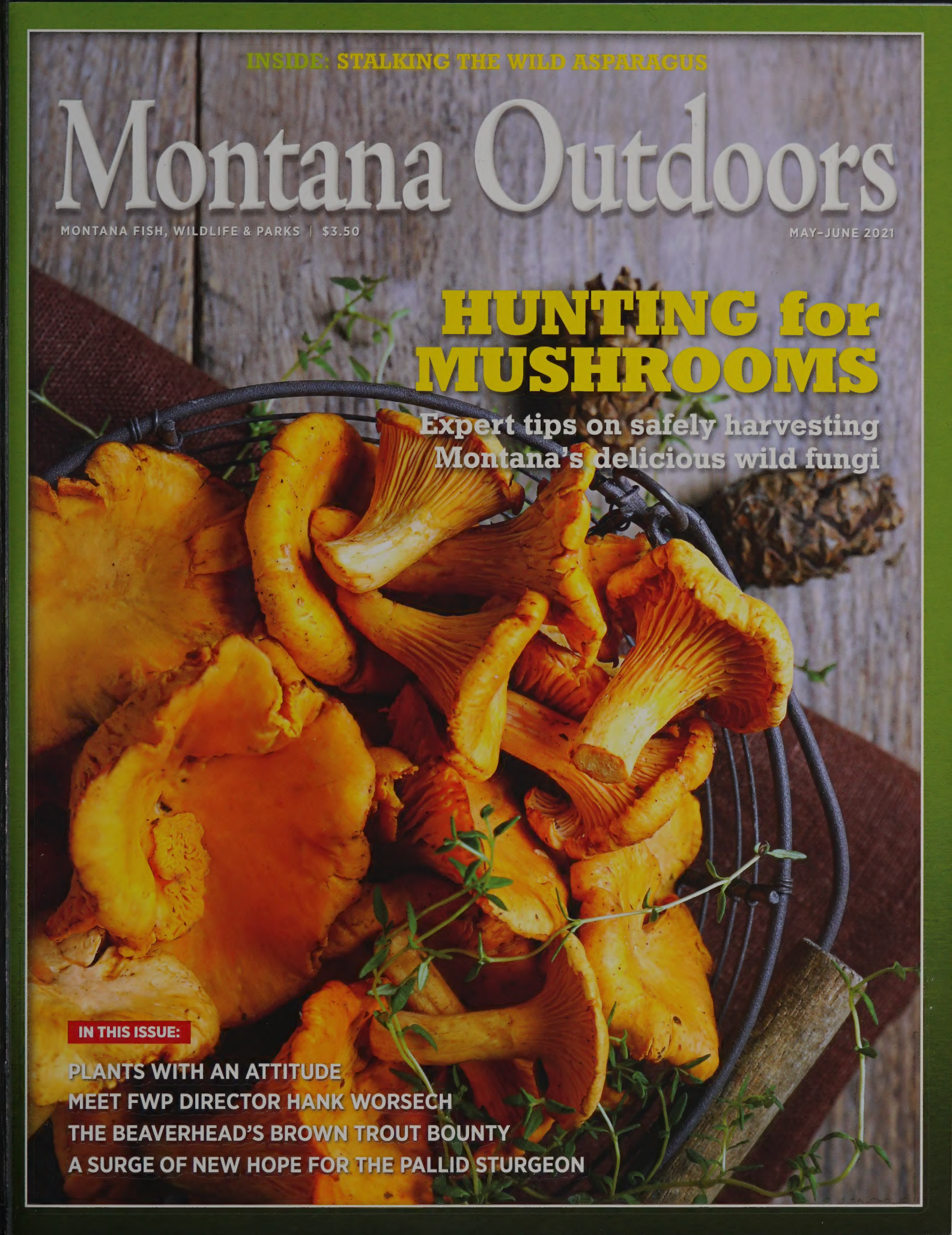
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MEET FWP DIRECTOR HANK WORSECH
THE BEAVERHEAD'S BROWN TROUT BOUNTY
A SURGE OF NEW HOPE FOR THE PALLID STURGEON

Montana Outdoors

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Montana Outdoors

MAY–JUNE 2021

FEATURES

12 Small River, Big Fish For years, the diminutive Beaverhead River produced phenomenal numbers of massive brown trout. Can those glory days ever return? *By Tom Dickson*

19 The Rise and Fall and Rise of Poindexter Slough A southwestern Montana community joins forces to bring a legendary trout stream back to life. *By Tom Dickson*

22 When Plants Fight Back Defensive strategies of wild vegetation. *By Ellen Horowitz*

26 A Beginner's Guide to Montana Mushrooming Expert advice on what—and what not—to pick and eat. *By Cathy Cripps*

34 Finding a Pulse for Pallids Why a brief surge from Fort Peck Dam mimicking natural spring runoff could help restore life to Montana's rarest fish species. *By Andrew McKean*

42 It's Not Easy Being Green Montana's amphibians have not escaped the die-offs plaguing much of the world. But some species are getting a boost from actions by tribal, state, and other wildlife programs. *By Julie Lue*

DEPARTMENTS

2 LETTERS

3 TASTING MONTANA Wild Asparagus with Hollandaise Sauce

4 OUR POINT OF VIEW

5 FWP AT WORK

6 SNAPSHOTS

10 OUTDOORS REPORT

48 SKETCHBOOK Howdy, New Neighbors!

49 OUTDOORS PORTRAIT Pygmy Nuthatch

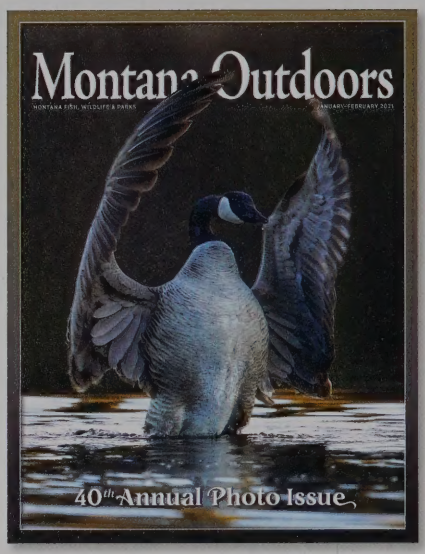
"REALTOAD" CAMO A Great Plains toad blends in with its rock and grassland surroundings. See page 42 to learn how agencies and organizations are working to help restore and protect toads and other amphibians. Photo by Nathan Cooper.

FRONT COVER Chanterelles are just one of many edible mushrooms available in Montana. See page 26 to learn which species are the easiest to identify and safest to eat—and which ones to avoid. Photo by New Africa Studio.

Photo issue fans

I received a copy of the *Montana Outdoors* 40th Annual Photo Issue as part of my Christmas gift from my children. I have lived in Montana my entire life and would never live anywhere but in this great state. The photo issue was like getting a ray of sunshine during this dark winter of Covid and politics. Thank you for an amazing issue filled with the most beautiful photos ever. I love every one and they brought back so many memories of my life and travels in Montana.

Nancy Rosenbaum
Havre



Thank you for your inspiring work, for lifting our spirits through photography. The diversity, the grandeur, and the detail in nature are fantastic, and we so appreciate that you've made these images available to us. Thanks again for all you do to showcase this gorgeous part of the world. We feel so blessed to live here in Montana. Your photos make us proud to call it our home.

Todd and Caren McLane
Billings

More comments on our lead and eagles article

Regarding your article, "Choosing the Unleaded Option" (September-October 2020): I've used solid copper bullets for hunting and stopped due to the over-penetration and "penciling" (little hole in, little hole out, little wound channel) that seems to occur too often.

One wildlife rehabber quoted in the article said, "We rarely see high lead levels in the summer," yet the article cites studies of the amount of lead left in Columbian ground squirrels. The vast majority of these are shot in the summer months. The same study noted the use of .17 and .22LR ammo but made no mention of the results from the much higher velocity .22 centerfire ammunition that is very commonly used. It seems some confirmation bias was in play with that study.

Robert Jones
Billings

As a recent convert to copper bullets, I wanted to share that I experienced two one-shot kills last season with Barnes copper bullets: one on a mature mule deer (lung shot) and one on a pronghorn (high front shoulder). In both cases, the bullet fully penetrated the animal (significant entry and exit channels). Bones were shattered and organs showed severe signs of trauma. This is what you want for a clean, quick kill, as we all know. Copper works.

David Russo
Hoboken, NJ

I am very gratified that you published the article on lead and eagles. Concerned about potentially poisoning wildlife and my family, I switched exclusively to unleaded ammunition for big game hunting about a dozen years ago and never looked back. In terms of both accuracy and lethality, copper bullets easily equal or surpass lead bullets. There simply is no need to use lead. Leaving gut piles behind for scavenging wildlife to include in their diet makes me feel that in a small way I am contributing to the ecosystem. It's good to know that these remains can be safe.

Mike Kantor
Missoula

I am sending along general continued admiration and support for your high-quality magazine, and had meant to send a timely letter with much appreciation for your article on the increasing use of nontoxic alternatives to lead ammunition. Well done! I was glad to see others sent in positive comments. I was relieved there was not a big negative outcry on the topic by those who find it threatening, and I think in part you headed that off by successfully portraying the story in a positive light (e.g., it is a choice that more and more people are making).

Beth Madden
Bozeman

> **"I think in part you headed that off by successfully portraying the story in a positive light (e.g., it is a choice that more and more people are making).**

Keep it comin'

You do great work with *Montana Outdoors*. As someone who takes pride in my state, our resources, and our people who work to conserve them, I take great pride in this magazine, and frequently point to it as a prime example of effective popular media for natural resource conservation awareness. You do a great service to the agency, and to all of us (human and wildlife) who benefit from it. I am anxiously hopeful that it will stay this way in coming years, and as a loyal supporter, am available to let my opinions be known to others if needed. Above all else, I want to keep getting your delicious recipes.

Patrick Cross
Bozeman

What about everyone else?

I read in your magazine that the federal Pittman-Robertson and Dingell-Johnson excise taxes on hunting and fishing gear, which are then given to the states for fish and wildlife management and conservation, are no longer sufficient to meet the needs of those resources. Maybe there should be similar taxes on other outdoor users such as on backpacks, skis, snowshoes, tents, mountain bikes, ATVs, and binoculars.

Ed Rittershausen
Polson

CORRECTION

In our article on Montana's diverse and abundant fishing ("Awesome Opportunities," November-December 2020), we mistakenly listed the number of miles of fishable coldwater streams and rivers in the state as 28,000. According to recent analysis by Ryan Alger, FWP GIS data analyst, the correct number is 5,776 miles. Montana has an additional 2,743 miles of fishable warmwater streams and rivers.

Wild Asparagus with Hollandaise Sauce

By Tom Dickson | Preparation time: 5 minutes | Cooking time: 15 minutes | Serves 2-3

Wild asparagus isn't a truly wild edible plant like watercress or camas root. It's actually the feral sproutings of plants cultivated in gardens decades ago. The seeds of those original plants spread, and now these yummy vegetables grow across much of Montana.

I'd searched the Helena Valley in vain for years before a colleague told me what to look for: Scan road ditches (public rights of way) for the 3- to 6-foot dead stalks of last year's plants. Asparagus favors slight slopes with some but not too much moisture. That's why ditches can be so productive. Streambanks are another good place to find the plants.

You can also scout for mature plants in midsummer when they resemble wispy Christmas trees with red berries (seed pods), or search for dead ones in fall when they turn yellow-tan. Mark the spots for spring gathering, which begins after several weeks of air temperatures in the high 60s and soil temperatures reaching 50 degrees. That's usually around the end of April and lasts until about Memorial Day.

Look at the base of old plants for young spears, which look exactly like the asparagus you see in a grocery store. Snap them off at the base, leaving at least one spear to mature into a flower stalk whose roots will spring up into next year's crop.

To find out if asparagus grows near you, ask around. Be aware that people can be as secretive and possessive of their asparagus harvesting spots as they are about morelling sites or fishing holes.

Many people eat wild asparagus raw, but it can also be steamed, grilled, baked, or boiled. This recipe, especially with toasted English muffins and slices of Canadian bacon, makes a perfect Mother's Day brunch.

—Tom Dickson is editor of Montana Outdoors

Spring

Summer

Fall

SHUTTERSTOCK

This easy recipe is adapted from one on the Food Network Kitchen website.

INGREDIENTS

1 lb. asparagus, woody ends trimmed
1 T. olive oil
¼ t. salt
Freshly ground black pepper

HOLLANDAISE SAUCE

1 large egg yolk
1½ t. freshly squeezed lemon juice
Pinch cayenne pepper
4 T. unsalted butter
½ t. salt

DIRECTIONS

Preheat oven to 450 degrees F.

Spread the spears in a single layer in a shallow roasting pan or baking sheet, drizzle with olive oil, sprinkle with salt, and roll to coat thoroughly. Roast about 10 minutes, until lightly browned and tender. Flip the spears with a spatula after about 5 minutes.

While the spears roast, put the egg yolk, lemon juice, and cayenne in a blender. Pulse a few times to combine.

Put the butter in a small microwave-safe bowl and heat in a microwave until just melted. With the blender running, gradually add the melted butter into the egg mixture to make a smooth, frothy sauce. If the sauce gets too thick and gloppy, blend in a teaspoon of lukewarm water. Season with salt and serve immediately, or keep warm in a small heat-safe bowl set over hot (but not simmering, because that will cook the egg in the sauce) water until ready to serve.

Spread the roasted asparagus on a serving platter. Grind a generous amount of pepper over the top. Top with hollandaise sauce. ■

Honesty, integrity, decisiveness

As FWP's new director, the 25th during this department's 120-year history, I want to begin by thanking outgoing director Martha Williams for her four years of leading this remarkable department, especially her work to improve agency inclusiveness, transparency, and public service and to protect and strengthen the public trust.

I'd also like to introduce myself to readers of *Montana Outdoors* so you know a bit about me and what to expect during these next four years.

I grew up in Minnesota, first in the Twin Cities and later in the state's northwoods. That's where I learned to love the outdoors, hunting white-tailed deer and fishing for walleye, largemouth bass, and northern pike. Later in life, I had the chance to visit Montana a few times. I thought I'd like to end up here, and my wife and I moved to this state in 1990. We've never looked back.

Over the years I've been fortunate to work in several different jobs, including as executive director of the Montana Department of Labor & Industry's Board of Outfitters and as a senior claims adjuster with the Montana State Fund. The two eras of my life that had the biggest influence were my 10 years with the U.S. Marine Corps and the 17 years I spent here at FWP, from 2002 to 2019, as chief of the department's Licensing Bureau.

Being a Marine has shaped my character and moral code. Marines value honesty, honor human dignity, and have respect for others. I am confident that my colleagues here at FWP and the legislators and others I've worked with over the years would tell you I abide by those standards.

Another thing about Marines: We very much like to succeed, whether it's in combat, in business, or leading a public agency like FWP. We learn the mission then do what it takes to achieve that mission. We are extremely results oriented.

Achieving success often requires learning from others. During my time at FWP, I have had the opportunity to work directly with three directors appointed by both Republican and Democratic governors. During the past four legislative sessions, I also worked as the department's legislative liaison. At the capitol, I built relationships with legislators from both parties, hearing their concerns about the department while helping them understand issues that affect FWP's ability to fulfill its stewardship responsibilities.

Looking ahead, I will continue the department's focus on protecting and restoring fish and wildlife habitat. I also want to strengthen relations between landowners and hunters, such as what we're accomplishing with the department's Hunter-Landowner Stewardship Project.

Another priority will be to further improve this agency's public service, from building relationships between biologists and landowners to improving the experiences that hunters, anglers, and state parks users have with our website and new automated licensing system.

THOM BRIDGE

> I'll always stress the importance of positive thinking. In my book, attitude is everything.

I take to heart the guiding principles from Donald Phillips's *Lincoln on Leadership*, which has been a major influence on my management style. Foremost is the 16th president's belief that people are a leader's most important asset. I will regularly travel the state to listen to and learn from game wardens, regional office workers, state parks maintenance crews, biologists, and others. As I have throughout my career, I'll also continue to build strong interpersonal relationships—with FWP employees, stockgrowers, conservation groups, outfitters, legislators, and others whose lives are affected by the resources this agency manages.

One thing you can always expect from me is decisiveness. I firmly believe that more harm is done by not making a decision than by making a bad one. With a bad decision, you can learn from your mistake and readjust. But with indecision, you end up doing nothing, and that weakens an agency's credibility and lowers morale.

I'll always stress the importance of positive thinking. In my book, attitude is everything. Whether you think you can, or think you can't, you're right.

Finally, I want to say how humbled I am to have been asked to lead this agency. I left retirement to take this job because many people urged me and I felt it was my duty. But I also welcomed the opportunity. FWP has a long and successful history of stewardship, one I'd seen firsthand. To play a role in helping our employees maintain that important mission will be an honor.

—**Hank Worsech**, Director, Montana Fish, Wildlife & Parks

THOM BRIDGE

PRODUCING PARKS PERMANENCE

TOM REILLY
Parks Division Assistant Administrator

I GREW UP IN CLANCY and earned an engineering degree from Montana State University, the first person in my family to attend college. After graduation I landed an engineering job with Boeing and moved to Seattle. It was a great company, but living in a big city just wasn't for me. After six years I returned to Montana, first working for the Architecture and Engineering Division of the Montana Department of Administration. In 1996 I was hired to run the FWP Fishing Access Program.

Being at FWP felt like home. All my life I've loved hunting, fishing, camping, and hiking, so this really was the place for me. As a die-hard elk hunter especially, it's great to work for a department filled with men and women as passionate about elk hunting as I am.

In 1999 I was hired as the Parks Division's assistant administrator. My main responsibilities over the past 22 years have been involvement with many land acquisitions for new or additions to state parks, and park infrastructure projects across Montana, like the road projects at Makoshika State Park and the Lone Pine State Park visitor center refurbishment.

The best part of my job is that it results in permanent additions to Montana's recreational, historical, and cultural sites. It's extremely rewarding to visit, for instance, the Pictograph State Park and Lewis & Clark Caverns State Park visitor centers and know that I helped make them happen.

Lately my Parks Division colleagues and I have been discussing the massive influx of state park visitors, both resident and nonresident. This puts a lot of pressure on our park staff and infrastructure, and we're working to address that. But we also recognize that our division is at the forefront of helping meet the growing demand for hiking, camping, and other outdoor recreation. In addition to managing 55 state parks, we provide grants to communities and organizations to develop and maintain hiking, off-highway vehicle, and snowmobile trails throughout Montana. We also administer the federal Land and Water Conservation Fund program for Montana, which provides grants for community recreational features across the state, like local ball fields, parks, playgrounds, and walking trails.

Each year, more and more people are coming to Montana to experience the "outside." I'm proud and confident that the FWP Parks Division is well positioned to help meet that challenge.

Robert Cook captured this image one June evening behind his son's house near the Gallatin River not far from Manhattan. "I set up, as concealed as possible, about 50 yards from where I'd seen this hen and her poults the previous day," he says. "After about an hour, at around 8 p.m., they flew up to the exact cottonwood limb as before, and I was able to get a few shots off with my 400 mm lens before the light faded." Cook says he has seen hundreds of photographs of wild turkey hens and poults over the years, but never one with the family group in a tree and the young nestled under their mother's wing. "It was a once-in-a-lifetime opportunity," he says. ■

Retired Billings school district computer technician **Michael McCann** and his wife were camping in the Custer National Forest near Red Lodge last August when he decided to fly his camera-equipped drone over nearby Rock Creek. "What I like about this shot is that you get a view of trees and the stream looking straight down. That's a perspective a person would ordinarily never see," he says. ■

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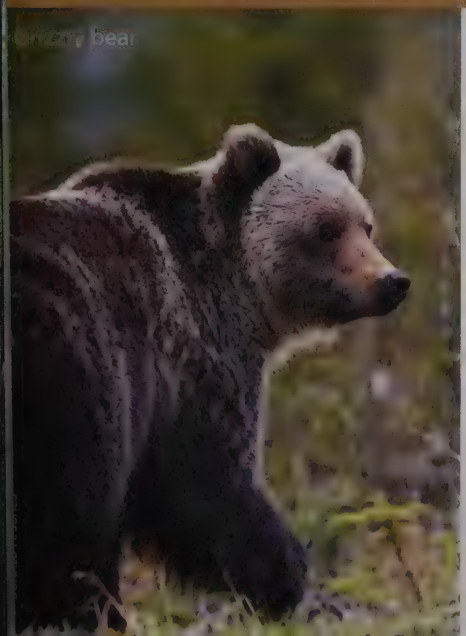

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30

Percent increase in Montana State Park statewide visitation from 2019 to 2020.

Planning can keep open spaces open

Open land in Montana's western half is filling up. Montana home construction starts declined during the Great Recession of 2008-09, but have since bounced back, primarily in fast-growing cities but also in more rural areas. A study by Bozeman-based Headwaters Economics found that, as of July 2020:

- Since 1990, 1.3 million acres of undeveloped land in Montana had been converted to housing.
- One-quarter of all homes in Montana had been constructed since 2000.
- Nearly half of the homes built from 1990 to 2018 were constructed on lots larger than 10 acres.
- More than half of homes built in areas with moderate or high risk of wildfire were constructed in the past 20 years.
- The four most populated counties and the cities there—Gallatin (Bozeman), Flathead (Kalispell), Yellowstone (Billings), and Missoula (Missoula)—account for more than half of Montana home construction since 2000.

"The good news is Montana still has plenty of undeveloped land," says Patricia Hernandez, executive director of Headwaters Economics. "But if we want to retain that open space, which is one of the state's top economic assets, we need to conserve those places. One way to do that is to build with denser housing that makes more efficient use of land near towns and cities." ■

A recent international designation could bring as much attention to Medicine Rocks' night sky as is now given the state park's famous sandstone formations.

STATE PARKS

Welcome, astrotourists

Visitors to Medicine Rocks State Park often say that the stars there shine more brightly than anywhere they've ever been. That's due to the lack of artificial light diluting the night sky above the remote southeastern Montana location, miles from any town. Recently the International Dark-Sky Association officially certified the park as an International Dark Sky Sanctuary. The only other certified dark sky site in Montana is Glacier National Park.

Dark Sky Sanctuary guidelines require that a site "must provide an exceptional dark sky resource where the night sky brightness is routinely equal to or darker than 21.5 magnitudes per square arcsecond." In other words: pitch black. Over two years, Sabre Moore, director of the Carter County Museum in Ekalaka, conducted sky quality measurements and concluded that Medicine Rocks State Park exceeded this benchmark.

"Medicine Rocks is known for its unique geologic formations that people have been visiting for thousands of years," says Chris Dantic, park manager. "Adding the IDA Dark Sky Sanctuary designation opens the park up to a new category of visitor: the dark sky enthusiast."

Dantic and Moore worked with Brenda Maas, director of marketing for Visit Southeast Montana Tourism, to complete the complex application. "It was a lot of work, but the long-term benefits of a significant international designation make it well worth it," Moore says.

The International Dark-Sky Association raises awareness about "light pollution" and, in Montana, co-sponsors dark sky star parties at Medicine Rocks and across the state.

A National Historic Site, Medicine Rocks features hundreds of sandstone pillars up to 60 feet tall with otherworldly shapes, undulations, holes, and tunnels. The park also contains sites of pioneer history and intact prairie wildlife habitats and species. Dark sky events and astrophotography workshops conducted within the park have also made it a destination for astronomical observers.

Maas says the IDA designation will bring outside dollars to Ekalaka, Baker, and the entire region. "Rural areas like those in southeastern Montana are perfectly positioned—literally and figuratively—to attract visitors who desire memorable outdoor activities like night sky viewing," she says. ■

FWP and Carter County Museum will sponsor IDA events at the park on May 22, June 20, July 22, and August 18. Visit ***stateparks.mt.gov/medicinerocks*** *or* ***cartercountymuseum.org*** *for more information about the events. Find out more about dark skies at the International Dark-Sky Association's Montana Chapter, at* ***montana.darksky.ngo****.*

CLOCKWISE FROM TOP LEFT: CARTOON BY MIKE MORAN; BEN PIERCE; SHUTTERSTOCK

WILDLIFE SCIENCE

Scientists clone first black-footed ferret

Remember Dolly the sheep? Meet Elizabeth Ann the black-footed ferret. She is the world's first black-footed ferret clone and the first clone of any endangered animal species in North America.

Black-footed ferrets, the continent's rarest mammal, are just the second species to be cloned for genetic rescue, following the successful cloning of an endangered Mongolian wild horse last August. The ferret's birth on December 10, 2020, followed years of experimentation by the biotechnology nonprofit Revive & Restore, the U.S. Fish & Wildlife Service, and other organizations.

The clone was produced using frozen cells from a female black-footed ferret that died in the mid-1980s. For decades, San Diego Zoo Global (SDZG) has been collecting and freezing tissue samples of dozens of endangered species for future cloning.

Researchers transferred the DNA of the donor ferret's cell into a domestic ferret's egg cell that had its DNA-containing nucleus removed. The egg developed into an early-stage embryo in a test tube and then was implanted into the womb of a surrogate female ferret.

When the surrogate gave birth, the tiny baby ferret had the exact same genetic makeup as the donor ferret from the SDZG freezer. "It's pretty inspiring that people 30 years ago saved those tissues, in case this could happen someday. So dreams do come true," U.S. Fish & Wildlife veterinarian Della Garelle told Colorado Public Radio.

Scientists hope the project can bring much-needed genetic diversity to the endangered species, of which only about 650—now including Elizabeth Ann—remain. ■

Above: Ben Novak, lead scientist of the biotechnology nonprofit Revive & Restore, with Elizabeth Ann at age three weeks. The black-footed ferret (shown below, a few months later) was cloned from the frozen cells of one that died in the 1980s.

TOP TO BOTTOM: REVIVE AND RESTORE; U.S. FISH & WILDLIFE AGENCY/AP

New Outdoor Hall-of-Famers

This past December, the Montana Outdoor Hall of Fame announced its 2020 inductees. "These are people who worked in the public and private sectors, often on their own dime, to advance what could be termed Montana's conservation consciousness," says Thomas Baumeister, MOHF executive director.

To read the biographies of the 13 inductees listed below, or those of the 2014, 2016, and 2018 inductees, visit mtoutdoorhalloffame.org.

- **Stewart Monroe Brandborg** (1925–2018): wilderness protection
- **Bruce Farling** (1953–): coldwater conservation
- **John** (1932–) and **Carol Gibson** (1937–2017): public access protection
- **Dale Harris** (1947–): wilderness protection
- **Gayle Joslin** (1951–): wildlife stewardship
- **George Bird Grinnell** (1849–1938): bison, national parks
- **Hal Harper** (1948–): coldwater conservation
- **Bob Kiesling** (1948–): land conservation
- **Paul Roos** (1942–2020): coldwater conservation
- **Gene Sentz** (1941–): wilderness protection
- **E. Richard "Dick" Vincent** (1940–): wild trout management
- **Vince Yannone** (1940–): wildlife education

THANK YOU to the 1,000-plus readers who entered our 2021 Favorite Photo contest. Here are the three randomly selected winners and the Photo Issue photos they chose:

Lynn Jenn (Hamilton, MT): Forsters tern hovering at Benton Lake NWR (Rod Schlecht, page 14)

Lois Ramberg (Chinook, MT): Canada goose (Brett Swain, cover)

Claudia Bartz (Suring, WI): Fall colors on the North Fork of the Flathead (Nicholas Parker, page 18)

SMALL RIVER, BIG FISH

For years, the diminutive **Beaverhead River** produced phenomenal numbers of massive brown trout. Can those glory days ever return?

BY TOM DICKSON

SMALL BUT PRODUCTIVE
The Beaverhead seen from a hill near Dillon looking south (upstream) shows the serpentine river snaking through pasture and hay fields. One of the nation's top trophy brown trout waters, the tiny river flows at just one-third the rate of the nearby Big Hole and one-tenth that of the Missouri and upper Yellowstone rivers. PHOTO BY LINNETT LONG

My first look at the Beaverhead River was such a letdown. For years I'd read about the storied blue-ribbon trout water in *Fly Fisherman* and other magazines, often mentioned with the equally renowned Big Hole, which flows nearby. I'd fished that big, brawling river, which in places surges past boulders the size of minivans. It's what I'd always imagined a Montana trout river to look like. I couldn't wait to fish what I assumed was the Big Hole's twin sister. Then I saw it.

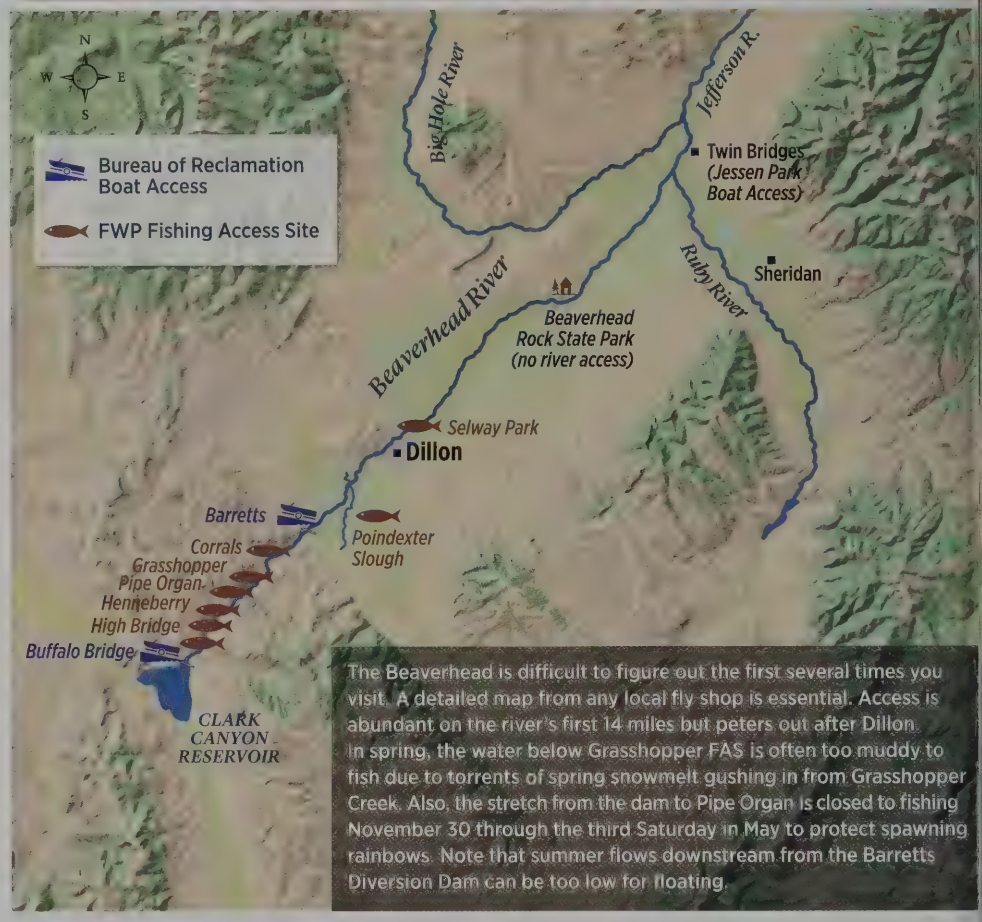
"*This* is the legendary Beaverhead?" I said to myself, looking down at a dinky river only about 25 feet wide. Both banks were lined with walls of willows. The surrounding hills, flinty and dry, looked like prime rattlesnake habitat (a suspicion confirmed by other anglers I met there). Whereas the Big Hole offered vast open reaches to maneuver a drift boat, the narrow Beaverhead seemed fishable only with a raft, and even that looked difficult.

I watched rafts float by with people on the oars frantically navigating through the river's tight twists and turns while anglers casting up front struggled to keep from snagging bankside brush.

And woe to the poor wading anglers! While trying to find footing in the deep, narrow channel, they risked getting run over by rafts barreling down from upstream.

Disillusioned, I drove up to Clark Canyon Dam, which controls the river's flow. After wading into the river about 300 yards downstream, keeping a respectful distance above a few other anglers, I began drifting a Pinkhead Sowbug with a Pheasant Tail dropper. After a half hour I never had so much as a nibble, but two guys downstream seemed to be hooking fish every time I looked. And I mean big fish. I walked down to watch one of them lead a particularly massive trout to the shallows. He knelt down, unhooked the football-sized brown, and let it slide back into the Beaverhead.

As I headed back to my car, I thought, "So this is what all the fuss is about."



The Beaverhead is difficult to figure out the first several times you visit. A detailed map from any local fly shop is essential. Access is abundant on the river's first 14 miles but peters out after Dillon. In spring, the water below Grasshopper FAS is often too muddy to fish due to torrents of spring snowmelt gushing in from Grasshopper Creek. Also, the stretch from the dam to Pipe Organ is closed to fishing November 30 through the third Saturday in May to protect spawning rainbows. Note that summer flows downstream from the Barretts Diversion Dam can be too low for floating.

A DAM (MOSTLY) HELPS TROUT

The Bannock, Shoshone, and other tribes who used the area for thousands of years as part of their seasonal movements likely weren't interested in fishing the Beaverhead, which then held native westslope cutthroats. If they wanted fish, they probably focused on the much bigger bull trout in the Clark Fork River to the north, or the ocean-running Pacific steelhead and salmon across the Continental Divide to the west.

The first mention of the river's trout was by Sergeant John Ordway of the Lewis and Clark Expedition, whose members waded up the serpentine stream from the Jefferson River in July 1805. Wrote Ordway: "*... the River crooked Shallow and rapid. Some deep holes where we caught a number of Trout.*" (See "Recognizing the 'beaver head,'" page 18.)

At the time, the Beaverhead looked much as it does today, with one huge exception. Clark Canyon Dam was built in 1964 to impound the Red Rock River and control irrigation flows for downstream cropland. What's now known as the Beaverhead begins below the dam, which controls the

Tom Dickson is editor of Montana Outdoors.

BROWN BEAUTY Above: Though the Beaverhead produces some rainbows in its upper reaches, the river is mainly a brown trout factory. Top left: From the dam to Dillon, boaters can choose from eight concrete ramps for launching, plus a few unofficial dirt ramps like this one directly below the dam.

CLOCKWISE FROM TOP LEFT: STEVEN AKRE; JOSHUA BERGAN; MAP BY LUKE DURAN/*MONTANA OUTDOORS*

river's water levels, clarity, and temperature.

That water makes or breaks the existing trout population: rainbows and browns that were introduced in the early 1900s and outcompeted the native cutthroats. "The fishery lives and dies by the dam releases," says Montana Fish, Wildlife & Parks fisheries biologist Matt Jaeger.

Before damming, stretches of the river dried up in summer or became too warm for coldwater species to survive. Afterward, the dam moderated flows, sending a steady stream of cold water from the base of the reservoir even in midsummer. Phosphorous and calcium carbonate in the surrounding geology fuels rich growth of zooplankton and aquatic insects that fatten the trout in the reservoir and downstream.

During the first years after the dam was built, water releases fluctuated widely during spring (rainbows) and fall (browns) spawning seasons, harming trout reproduction. Heavy flows flooded shallow areas, where trout then spawned. A few weeks later, the dam would hold back water, leaving eggs high and dry.

According to a 1985 *Montana Outdoors* article, FWP officials in the 1970s convinced the Bureau of Reclamation, the dam's owner and operator, to stabilize flows during the spawn. The resulting trout population boomed, increasing five-fold from 600 trout per mile—"probably fewer than existed before dam construction," wrote author Jerry Wells, then FWP regional fisheries manager in Bozeman—to 3,000 per mile. "The Beaverhead River [now] supports one of the most productive wild trout fisheries in the nation," Wells wrote.

As has been true for decades, browns outnumber rainbows roughly 5:1 in the Beaverhead's upper few miles; downstream from Pipe Organ Fishing Access Site the river is almost all browns.

Though it hardly seems possible, the trout population further improved in the late 1990s. Five consecutive years of heavy snows and steady rains filled the reservoir and allowed for abundant spring and fall releases that inundated additional downstream habitat with trout-producing water. "There were so many big fish in there during that time it was unbelievable," says Jaeger, who has been enamored with the river since first fishing it at age 20 in 1996. "The biggest trout I ever caught was a 27-inch rainbow that must have weighed 10 pounds. When it jumped out of the water, another angler yelled over at me, 'That's a *steelhead*!'"

BOOM THEN BUST

News of fish like that travels fast, even in the days before YouTube and Instagram. Anglers from across the country descended on the Beaverhead. Crowding got so bad in the 1990s the Montana Fish, Wildlife & Parks Commission closed, on a rotating schedule, certain sections of the Beaverhead and the nearby Big Hole, experiencing its own angling boom, to float fishing by nonresidents and outfitters. The stretches were only open to resident and nonresident wading anglers and

resident noncommercial floaters. In addition, the commission placed a moratorium on new outfitters for both rivers and capped the number of client days during the peak season for all existing outfitters to their "historical use."

Over the past two decades, outfitters have learned to live with the new rules, though some still say the restrictions weren't necessary and initially hurt their businesses. Local anglers and nonresident waders continue to support the restrictions. The now-called Fish and Wildlife Commission has considered similar rules for other Montana rivers experiencing increased angling pressure.

Since the Beaverhead's heydays, the number of trout per mile has stayed about the same, but the percentage of fish over 18 inches has declined dramatically. From 1997 to 2000, the river averaged 2,044 brown trout per mile, with an astonishing 35 percent over 18 inches. The average number of fish held steady through the drought years of 2001-09 (1,968) and 2013-18 (2,039), but the share of big trout plummeted to just 6 percent.

BROWN ON! Fishing near Pipe Organ, an angler plays a big trout hooked while nymphing. Insect hatches are relatively uncommon; most fish are caught by nymphing tiny midge and *Baetis* patterns.

What accounts for the trophy trout decline? "Mainly it's winter discharge," Jaeger explains. Though the Bureau of Reclamation maintains stable flows during spawning seasons, the lack of snow over the past two decades often forced the agency to hold back water in the reservoir to provide enough for irrigators the next growing season. "Winter flows make a huge difference in the number of fish, especially trout over 18 inches, that the river can support," Jaeger says.

During the late 1990s, average winter discharge was 325 cfs. The average during the past eight years has been just 68 cfs. "With plenty of winter water you can have lots of trout and lots of big ones," Jaeger says. "But with little water, it's one or the other, and

Anglers: Get ready to grumble

The Beaverhead might be the most frustrating trout river you've ever fished. There's all those massive fish, many of them visible. But like a giant spring creek, the river is so productive that trout have more than enough aquatic insects floating past their nose; they don't need to move even a few inches to look at—much less eat—your offering. All that underwater food also keeps the biggest, smartest fish from coming anywhere near the surface except at night. Why risk getting grabbed by an osprey when you can feed hidden in deep water?

Then add the challenge of trying to catch those big fish in deep, fast-moving current where an errant cast can leave your just-tied double-nymph rig wrapped around a willow branch. *Aargh!*

So how does an angler fish this river successfully? Here's what I've learned from local fly shop owners, my own experience, and Montana fishing guidebooks:

The Beaverhead flows about 80 miles north from Clark Canyon Reservoir to Twin Bridges, where it joins the Ruby River then the Big Hole to form the Jefferson. It has three main stretches: Clark Canyon Dam to Barretts Diversion Dam (which draws off about half the river for irrigation), Barretts to Dillon, and Dillon to Twin Bridges. The best—though most crowded—fishing is the upper stretch. Fish numbers decline as you move downstream, but so do angler numbers.

Beaverhead fishing is mainly with nymphs. Mainstays include the Zebra Midge, Pheasant Tail, and Copper John, all in small sizes (20s and 22s). Some guides say the Beaverhead's trout have seen so many bead-head nymphs the fish are more likely to take unbeaded old-school versions. Many trout also seem to recognize what a bright strike indicator floating overhead represents and will refuse flies fished underneath. Try using the white Palsa pinch-on floats, which resemble water foam.

For the rare dry-fly fishing, there's some midge action in early March, Blue-winged Olives from about St. Patrick's Day through April, and sporadic caddis hatches from mid-May to the end of September. Dry-fly flingers occasionally pick up fish on Yellow Sallies from late July through Labor Day weekend. As on trout streams statewide, terrestrials (ants, beetles, and grasshoppers) can work all summer. The dry-fly season, such as it is, ends in the fall, when a few *Baetis* duns might pop on the rare cloudy or rainy days.

sometimes neither." That was the case following several dry years in the late 2010s, when the average winter discharge trickled to only 41 cfs. By 2019, brown trout numbers had dropped to just 844 per mile; only 5 percent topped the magic 18-inch mark. Last year numbers climbed a bit to 1,052, with 17 percent of those trophy size. "Fingers crossed it will keep increasing," Jaeger says.

"FRYING PAN" TROUT MANAGEMENT

Another challenge facing the Beaverhead's trout is periodic springtime sediment washing in from Clark Canyon Creek, which joins the river about a mile and a half below the dam. The severe sediment loading, from geologic formations of volcanic ash in

OPTIMIST CLUB FWP fisheries biologist and Beaverhead fan Matt Jaeger with a typical brown. "This river has incredible potential to grow a lot of big trout. We've seen it happen before and I'm trying to make it happen again," he says.

WHAT BROWNS WANT Miles of bankside willows produce endless overhead cover that brown trout love. That habitat plus steady, cold flows from Clark Canyon Dam and abundant aquatic insects combined to make the Beaverhead one of the nation's top brown trout fisheries in the late 1990s. From 1997 to 2000, the river averaged more than 2,000 browns per mile, a remarkable one-third of which were over 18 inches. Paltry winter flows in recent years have caused trophy trout numbers to dwindle.

surrounding hills that are prone to landslides, often comes after large storms or rapid snowmelt.

"It's like having tons of liquid concrete pour into the river," Jaeger says. "The slurry fills in every nook and cranny in the streambed and suffocates aquatic insects." Sediment loading in 2006 and 2010 caused the population to decrease by 50 percent. "Historically, heavy storms or snowmelt resulted in dam releases creating high flows in the Beaverhead River and Clark Canyon Creek at the same time. So all that sediment would be washed downstream," Jaeger says. But during years when little water is released from the dam, the creek's sediment settles in the Beaverhead's riffles and pools.

Jaeger says he has been working with the Bureau of Reclamation and downstream irrigators to reserve more water in the reservoir, so it has been able to periodically release a "flushing flow" to wash out sediment when necessary. "The flushes seem to be working," he says. "We're now seeing cleaner gravels, and anglers are reporting better insect hatches."

"I've fished New Zealand, Argentina, the Henry's Fork in Idaho, all over, and the biggest trout I've ever caught came from the Beaverhead."

In addition to low winter discharges and sedimentation, another issue hampering the trout fishery is fish harvest—surprisingly, not too *much* harvest, but too *little*. "If you have a whole bunch of smaller fish, as is the case now, you can't have as many big fish. There's simply not enough space," Jaeger says. His goal is to increase the proportion of trout over 18 inches to 20 or even 25 percent. "Unless we get some great water years, the only way to do that is to free up more space for the 17- and 18-inchers to grow a bit larger. And that requires harvesting more of the smaller 10- to 16-inch fish," he says.

That's not an easy sell to anglers raised on the sanctity of catch-and-release. "They understand the science," Jaeger says, "but many tell me, 'Matt, I just can't kill a trout.'"

They may have to find a way. Jaeger believes "frying pan" management is an essential management tool for the Beaverhead. With the long-term forecast calling for even less precipitation, culling small fish may be the only way to return the trout population to some semblance of its former glory.

"I've fished New Zealand, Argentina, the Henry's Fork in Idaho, all over, and the biggest trout I've ever caught came from the Beaverhead," the biologist says. "The potential is still there. My job is to find ways for the river to reach its potential."

Recognizing the "beaver head"

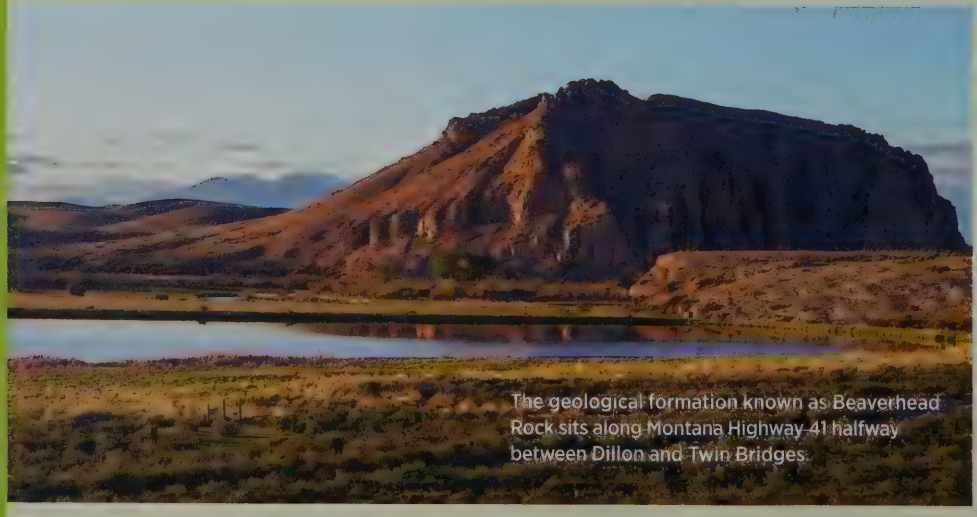
Native Americans had lived near what is now called the Beaverhead River for thousands of years by the time Lewis and Clark waded up the winding stream from the Jefferson River in July 1805. The Corps of Discovery was heading southwest, hoping to find Shoshone Indians. They wanted to acquire horses and ditch their canoes, which were increasingly useless as they traveled upstream in ever-narrowing rivers.

Accompanying the men was Sacajawea, an 18-year-old woman who had grown up among the Shoshones. Near what is now Twin Bridges, she recognized in the distance a large rock landmark known as the "beaver head" for its faint resemblance to the toothy rodent.

Captain Meriwether Lewis was excited by the news. "She assures us that we shall find her people either on this river or on the river immediately west of its source; which from its present size cannot be very distant," he wrote in his journal. Sure enough, a few days later the Corps was visited by Shoshone chief Cameahwait, who turned out to be Sacajawea's brother. Cameahwait helped the expedition obtain guides and horses, in part to repay them for reuniting him with his long-lost sister, who had been kidnapped by the Hidatsa Indians six years earlier.

In honor of the fortuitous meeting, Lewis named the spot, now submerged beneath Clark Canyon Reservoir, Camp Fortunate. A sign on the shoreline marks the site.

The Beaverhead River was later named for that rock, now a state park. Nearby is 8-acre Clark's Lookout State Park, on a hill above the river that Captain William Clark climbed to scout the surrounding landscape.



The geological formation known as Beaverhead Rock sits along Montana Highway 41 halfway between Dillon and Twin Bridges.

PHOTO: ARTHUR T. LABAR; PAINTING: LEWIS & CLARK, BY N.C. WYETH

JOHN JURACEK

AQUATIC RENEWAL An angler fishes Poindexter Slough back when it was still a "spring" creek. Those days are gone, but a recent community-led restoration offers hope for better fishing ahead

The Rise and Fall and Rise of POINDEXTER SLOUGH

A southwestern Montana community joins forces to bring a legendary trout stream back to life.

BY TOM DICKSON

This is the story of how a community came together to restore one of Montana's top trout waters.

Located just a few minutes' drive south of Dillon, Poindexter Slough—in western parlance, a "slough" is a riverside channel—runs nearly 5 miles through the old Beaverhead River bed. Centuries ago the river naturally shifted a quarter mile west, leaving Poindexter as a long oxbow in the old basin, cut off from the new channel.

Starting in the 1890s, settlers moved in and began growing alfalfa, drawing water from nearby Blacktail Creek. The stream sits higher in elevation than the Beaverhead or Poindexter, allowing gravity to convey water to irrigation canals. After fields were flooded each spring to hydrate newly planted crops, the standing water seeped into the water table. In summer, the earth-cooled water bubbled back up into nearby Poindexter Slough, turning the long oxbow into a cool, clear stream rich in underground minerals that fueled aquatic insect production.

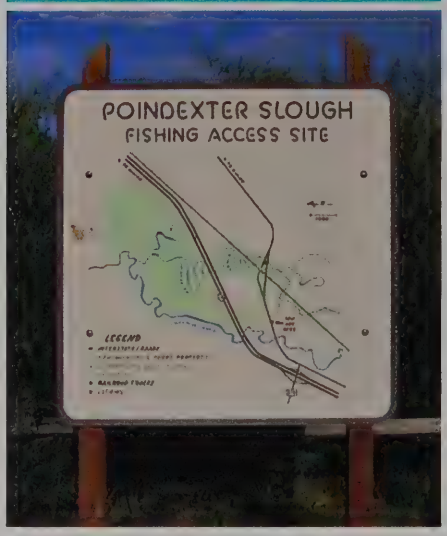
"Technically it wasn't a spring creek, but it functioned like one," says Zach Owen, watershed coordinator for the Beaverhead Watershed Committee.

As on the nearby Beaverhead, all those bugs fattened up brown and rainbow trout, making Poindexter a top draw for both nonresident and local anglers. From the 1950s through the early 21st century, Dillon residents could fish the "spring" creek before or after work and stand a good chance at tying into a 3-plus-pound brown. Then things started to go south.

FROM FLOOD TO PIVOT

Starting in the 1980s, farmers and ranchers began switching from flood to pivot irrigation, which watered crops with 300-yard-long sprinklers that move around a central pump. "Pivots" use water more efficiently and require less human labor, explains local rancher Carl Malesich, who chairs the BWC.

Tom Dickson is editor of Montana Outdoors.



Yet because it puts far less water on the land itself, producing almost no underground seepage, pivot irrigation is less beneficial for Poindexter trout. The "springs" that fed the slough for a century dried up.

To sustain both trout and crops, more water was diverted from the nearby Beaverhead via Poindexter Slough into Dillon Canal, which provides additional irrigation water for area landowners. Unfortunately, with that river water came river silt.

During the 1990s and early 2000s, a steady influx of silt began filling Poindexter's pools, robbing trout of hiding places and winter habitat. Pools up to 6 feet deep turned into shallow flats that warmed quickly under the hot summer sun. Silt also filled in gravel where aquatic invertebrates lived and trout spawned. The loss of flood irrigation in nearby fields also removed the steady supply of cold, oxygenated water bubbling up from underground that invigorated aquatic life.

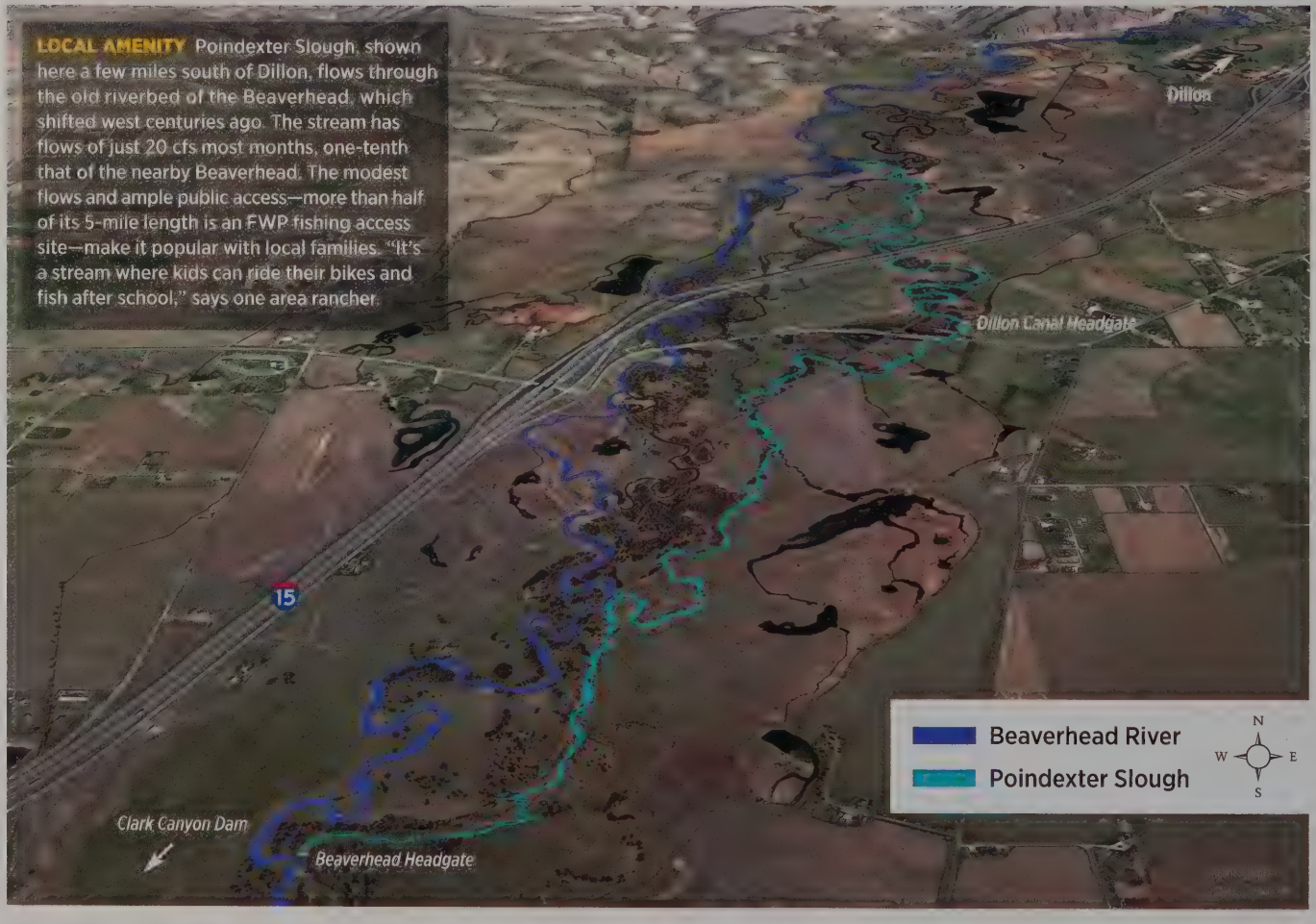
> "Technically it wasn't a spring creek, but it functioned like one."

Though the area continued to support abundant white-tailed deer, beavers, muskrats, songbirds, and waterfowl, big trout fared poorly. Matt Jaeger, Montana Fish, Parks & Wildlife fisheries biologist in Dillon, says that while total trout numbers stayed roughly the same over the ensuing decades, at about 1,500 per mile, the percentage of trophy browns dwindled. Before the 1980s irrigation shift, about 5 percent of Poindexter's trout were over 18 inches long. By the 1990s, that had dropped by more than half to less than 2 percent. "The habitat no longer supported big trout," Jaeger explains.

Anglers went elsewhere. FWP creel surveys showed fishing use plummeted from more than 4,000 "angler days" per year to around 600. Angler satisfaction dropped too, from "excellent" to "poor." One of the nation's most famous trout fisheries had all but collapsed.

WORKING TOGETHER

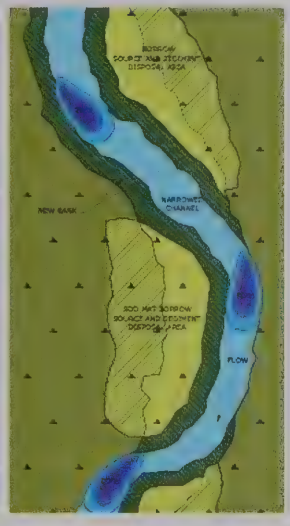
Around 2014, the Beaverhead Watershed Committee began seeking solutions to Poindexter Slough's silt problem. Under the motto "Working together for the river we share," the committee and partners raised nearly $1 million for the project with bake



LOCAL AMENITY Poindexter Slough, shown here a few miles south of Dillon, flows through the old riverbed of the Beaverhead, which shifted west centuries ago. The stream has flows of just 20 cfs most months, one-tenth that of the nearby Beaverhead. The modest flows and ample public access—more than half of its 5-mile length is an FWP fishing access site—make it popular with local families. "It's a stream where kids can ride their bikes and fish after school," says one area rancher.

PHOTO: MONTANA FWP; MAP: LUKE DURAN/*MONTANA OUTDOORS*

MAKING A COMEBACK For a century, water from flood irrigation in surrounding hayfields seeped below ground, only to bubble back up into Poindexter, creating spring creek–like conditions and a world-class fishery. After flood irrigation was replaced by sprinklers (above left) starting in the late 1980s, the "springs" dried up. More water was brought in from the Beaverhead River, and with it silt that filled in pools and smothered aquatic insect habitat (above right). In recent years, the Beaverhead Watershed Committee and local supporters raised nearly $1 million to pay for narrowing the channel by half and deepening pools (below left and right). Periodic high flows from the Beaverhead through a new, enlarged headgate flush silt out of the stream. The result has been a higher percentage of trophy brown trout than biologists have seen in years.



sales, grants, and private donations. Major partners included the Beaverhead Conservation District, FWP's Future Fisheries Habitat Improvement Program, Dillon Canal Company, and local businesses. The committee hired Bozeman-based Confluence Consulting, an aquatic engineering and design firm. The company determined that narrowing the slough by 50 percent and providing "flushing flows" of 200 cfs every five years or so would mimic historical spring runoff flows. The periodic flushes would keep sediment moving, deepen holes, and clean substrate gravel. At all other times the stream would run at its normal 20 to 50 cfs.

From 2015 to 2018 a new, larger headgate was installed at the upstream end of the slough to bring in heavy flushing flows. Downstream, the Dillon Canal's diversion and headgate were replaced to eliminate a silt-holding backwater and a barrier to upstream-moving trout. Excavators and bulldozers dredged tons of sediment from pools, rerouted and then narrowed channels, and added tons of gravel to the newly configured stream. Crews planted willows, whose deep roots would hold contoured banks in place.

POINDEXTER THRIVES

At one point when funding for the Poindexter Slough Restoration Project ran low, local contractors R. E. Miller & Sons Excavating continued working at no charge. "That's just one example of how the community came together to make this project happen, and it shows what you can accomplish when a trout stream restoration is designed to meet the entire needs of a community," Owen, the watershed coordinator, says.

Today, Poindexter Slough is thriving. Riffles have clean gravel and pools are deep. Young willows have taken root. The water zips along at a steady clip, providing habitat for trout and irrigation water for downstream fields. Jaeger says overall trout numbers are down a bit from five years ago, "but the percentage of big fish is much higher."

The biologist notes that Poindexter Slough's days as one of Montana's premier "spring" creeks ended with flood irrigation. "Now it's more like a high-quality side channel of the Beaverhead," he says.

Which is a no small thing. The Beaverhead remains one of the state's most productive trout fisheries, some years producing more brown trout over 18 inches per mile than any other in Montana, including rivers up to 10 times larger. "But for Poindexter to properly function ecologically and be part of that world-class fishery, it needs a regular silt flush," Jaeger says. "Thanks to the community rallying around this project, that's now happening."

ALL PHOTOS AND GRAPHICS: MONTANA FWP EXCEPT IRRIGATION PIVOT: SHUTTERSTOCK

WHEN PLANTS FIGHT BACK

DEFENSIVE STRATEGIES OF WILD VEGETATION

BY ELLEN HOROWITZ

Two other hikers approached on the narrow, brush-choked trail. As I stepped back to give them room to pass, something needle sharp seemed to whack the back of my legs. Whirling around to confront what I thought were hornets, I instead saw that my "attacker" was a gnarly, spine-covered plant descriptively known as devil's club. It was a species I knew well and had always tried to avoid. But in my haste to move out of the way, I overlooked it and suffered the consequences.

Plants can't run but, like devil's club, many put up a fight. Some have chemicals on their leaves or elsewhere that cause intense skin irritation. Others sport thorns, spines, prickles, and a variety of tiny, stiff, hairlike structures—all collectively known as spinescence.

No conclusive explanation exists for why these defensive mechanisms evolved. The long-held hypothesis is that they are meant to ward off plant-eating mammals. But that doesn't explain why, for instance, deer happily munch on prickly wild roses and black bears eat poison ivy leaves.

Whatever the reason, the irritants and pointy parts of several plants can annoy or even injure campers, hikers, hunters, mountain bikers, and others who enjoy the outdoors. The secret to staying safe is to find these plants before they find you. To that end, here are several common plants that cause pain or skin irritation if they catch you off guard.

Ellen Horowitz is a writer in Columbia Falls.

GET THE POINT

Yucca

Descriptive names for this plant—Spanish bayonet, Spanish dagger, sword grass—speak volumes about its defense. Each leathery, sword-shaped leaf terminates in a sharp, spiny tip that can cut and puncture clothing and skin.

Because they are so big and distinctive, yucca are usually easy to avoid if you're paying attention. But start to daydream or look up at an overhead raptor and a painful poke in the shin will remind you that danger lurks below. Hiking in low light or darkness can be especially hazardous in areas where yuccas grow.

Where: Central and eastern Montana in sandy or stony soils of open, dry habitat such as plains and badlands.

Prickly pear cactus

These cacti often form low-growing mats that make them hard to see and avoid. You're walking along, feel the spine in your foot, then look around and see that you're surrounded. Smart pronghorn hunters wear thick leather gloves and kneepads to avoid being pierced while crawling through sagebrush prairie. Just as painful, but harder to remove than the prickly pear's spines (a type of modified leaf), are its thin, hairlike prickles that easily embed in exposed skin.

Where: Mostly east of the Continental Divide in grasslands and sagebrush steppes.

Hawthorn

These shrubs or small trees hide their dagger-sharp thorns beneath dense foliage and clusters of flowers or fruits on intricately arranged branches. Technically, thorns are a type of modified branch that resemble spikes. Because they remain firmly attached to the branches from which they grow, they can easily tear clothing and puncture flesh. Hawthorns can grow up to 15 feet tall. Depending on the species, their thorns range from ½ inch to more than 2 inches long. Legend claims that Paul Bunyan used an entire hawthorn tree as a backscratcher. Magpies often nest in hawthorns for protection from predators.

Where: Mostly western and central Montana in riparian forests, thickets, fields, and valleys.

Silver buffaloberry

This large, dense shrub (up to 12 feet tall) produces beautiful silver leaves and bright red fruits. But beware its thorny branches. Also known as thorny buffaloberry, this prairie shrub provides cover and food for many small wildlife species, including pheasants. To protect their hunting dogs' eyes from injury when rooting roosters out from buffaloberry, some upland bird hunters fit their pets with plastic goggles.

Where: East of the Continental Divide along rivers and streams and in grassland depressions and gullies.

Wild rose

"Rose is a rose is a rose," said author and poet Gertrude Stein, and most people can easily recognize one. But few know the correct name of the armaments on the stems of rose bushes (and many other plants). What are typically referred to as thorns are, botanically speaking, prickles. Prickles are sharp outgrowths found on the epidermis or outer "skin" of a stem. Some rose prickles look like miniature shark's teeth.

Five species of wild rose grow in Montana. Their prickles, all painful when grabbed, vary in size, shape, and density.

Where: Statewide in open forests, valleys, grasslands, and riparian thickets.

Devil's club

The plant that accosted me on the trail is a member of the ginseng family and has densely packed, ½-inch needle-sharp spines along its woody stem. The yellowish spines also cover the leaf stems and veins on the bottom sides of its large (4- to 12-inch) maplelike leaves. Reaching heights of 3 to 6 feet, devil's club grows in dense, impenetrable thickets or scattered locations in forests of western red cedar, western hemlock, and western yew.

Where: Across northwestern Montana in shady, moist-to-wet mountain forests and along streams.

Gooseberry

According to the *Manual of Montana Vascular Plants* by Montana botanist and author Peter Lesica, "Gooseberry bushes have spiny twigs"—bristly stems and branches covered in prickles—while their look-alike cousins, the currants, are "unarmed." Gooseberry leaves are shaped like small maple leaves with toothed or scalloped edges. Prickle density varies among the six different species.

Where: Western Montana in moist to wet forests, rocky hillsides, avalanche chutes, and riparian habitats from low mountain to subalpine zones.

Thistles

Many people think all thistles with lavender flowers are Canada thistles, an invasive species. But many Montana thistle species—some desirable natives, others invasives—have lavender flowers, including the bull (non-native), Scotch (non-native), musk (non-native), and wavyleaf (native). All thistles are members of the aster family and have prickly stems and leaves.

Where: Statewide in disturbed ground, roadsides, fields, and open forests.

RASH REACTIONS

Stinging nettles

With their opposite leaf arrangement and square stems, nettles look like wild mint. And even though nettles are edible, when cooked properly, do not touch them with your bare fingers, arms, or legs. The nettle's tiny, colorless hairs hiding on all parts of the plant act like miniature hypodermic needles that inject formic acid, histamines, and other chemicals into your skin. The "sting" can leave a burning, itching sensation that lasts from minutes to hours. Plants often grow 3 feet or taller.

Where: Found statewide in rich soil in meadows, along streams, and in open forests from valley to subalpine zones.

Cow parsnip

This hefty member of the carrot family has huge leaves, 4 to 12 inches wide, and flat-topped clusters of white flowers (up to 8 inches across) that grow on 3- to 6-foot stems. Contact with cow parsnip, followed by exposure to bright sunlight, causes some people to develop a painful sunburn-like reaction known as photodermatitis.

Where: Western third of the state from valley to subalpine zones, in moist soils associated with avalanche chutes, open forests, riparian areas, and thickets.

Western poison ivy

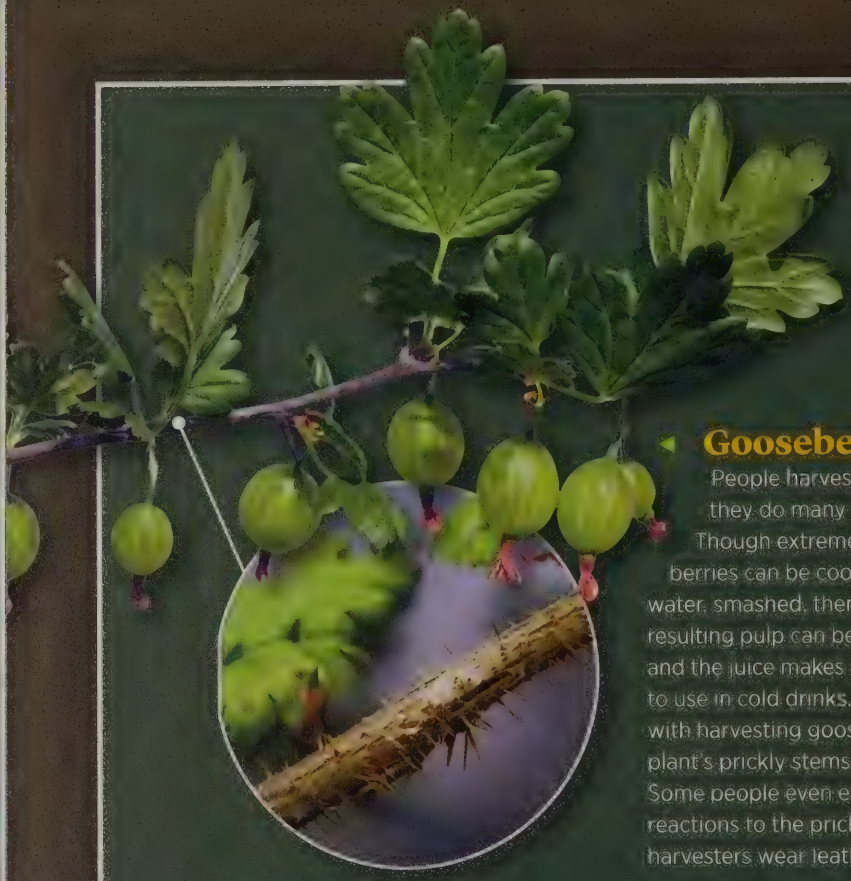
"Leaves of three, let it be" is a great way to identify this small, low shrub. The top leaflet is slightly larger and attached to a slightly longer stem than the other two leaflets. The shiny green leaves turn bright red in autumn.

All parts of the plant harbor an oily resin (urushiol) that causes an allergic reaction that shows up as red, extremely itchy bumps on the skin. Urushiol adheres to clothing, boots, backpacks, and pet fur and can linger for several days. Fortunately, poison ivy's cousins—poison oak and poison sumac—do not grow anywhere in Montana.

Where: Found in more than 20 counties from the northwestern to southeastern corners of the state. Poison ivy shows up mainly along lakeshores and banks of rivers and streams.

VERY PRETTY,

SOME ATTRACTIVE OR ED
PUT UP A FIGHT IF YOU C



Gooseberry

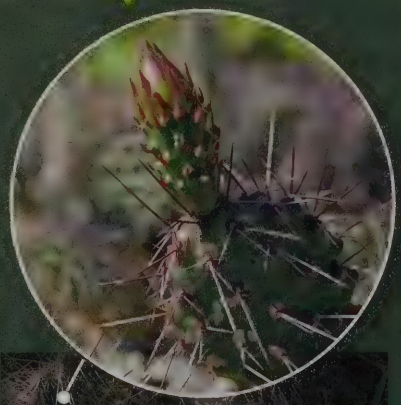
People harvest gooseberries as they do many other wild berries. Though extremely tart, gooseberries can be cooked with a little water, smashed, then strained. The resulting pulp can be used as pie filling, and the juice makes an excellent syrup to use in cold drinks. The challenge with harvesting gooseberries are the plant's prickly stems and branches. Some people even experience allergic reactions to the prickles. Experienced harvesters wear leather gloves.

Devil's club

The enormous leaves and clusters of red fruits are attractive to look at up close. But beware this plant's concealed weapons of needle-sharp spines lurking beneath the foliage. Handle with care.

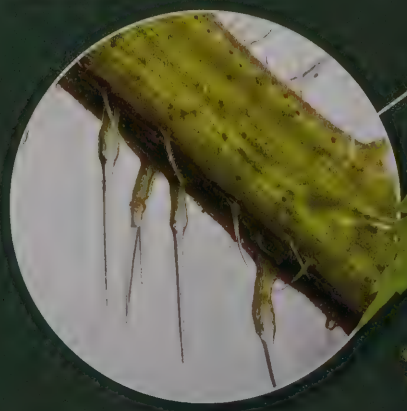
Prickly pear cactus

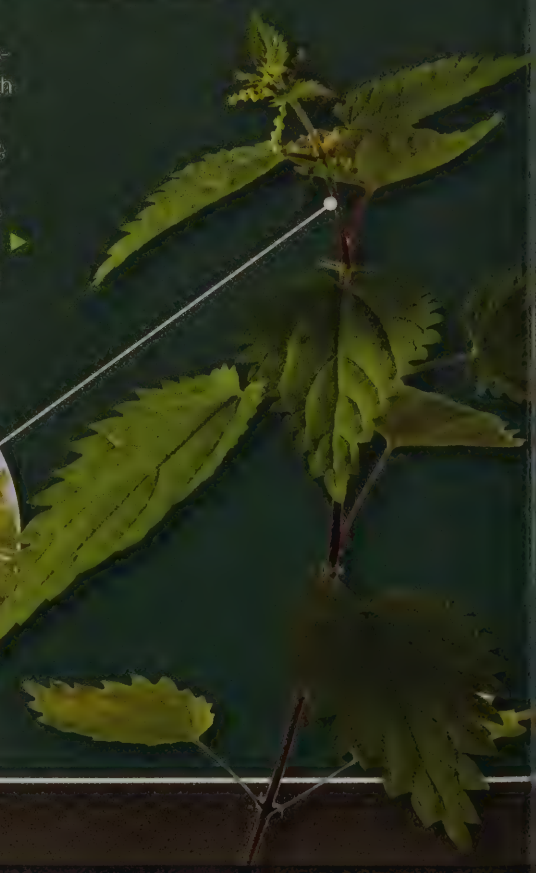
Ouch! Imagine the challenge for native people or Lewis and Clark trying to avoid these spine-covered plants while walking across a prairie wearing leather mocassins.



Stinging nettle

It takes a few minutes for the chemicals injected via the tiny hairs on nettles to set your skin on fire. As a result, many people wearing shorts have waded deep into fields of nettles before realizing what they've done. The burning itch can be intense. If you're near a stream or river, where nettles commonly grow, find relief by submerging your legs or arms in the cold water. At home, apply tape to your skin to pull out the hairs, then apply a soothing paste of baking soda and water.





YET...

BLE PLANTS CAN T TOO CLOSE.

Thistles

Thistles provide food for many animals. Some human foragers savor the young, peeled stems of the non-native musk, or nodding, thistle (shown here). Whether weeding or harvesting, wear gloves when handling.

Hawthorn

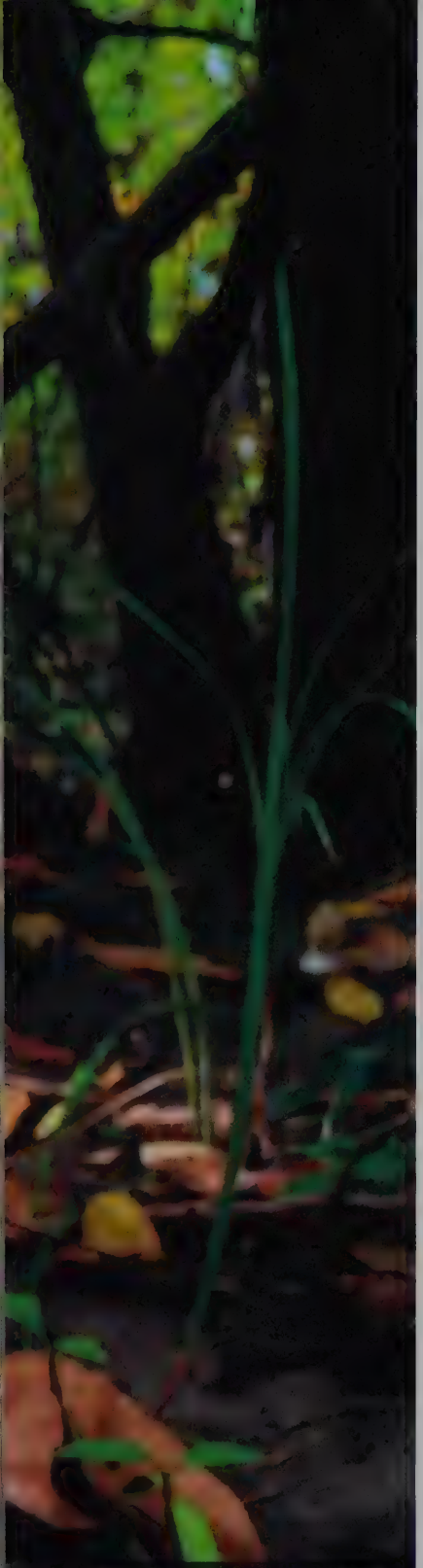
Like the silver buffaloberry, the hawthorn is armed with long, sharp thorns that can tear clothing or even puncture skin.

Poison ivy

Montana is lucky not to have poison oak or poison sumac. But we are home to the infamous three-leaved poison ivy. If you think you've walked through a group of this low-growing plant, wash, with soap and water, your exposed skin as well as boots, socks, and pants. Poison ivy leaves are covered in an oily rash-inducing resin that can be transferred to your face by your fingers.

Yucca

This may be Montana's most potentially painful plant. Its needle-tipped leaves make it definitely one you don't want to stumble onto.



PRETTY AND TASTY Resembling fairyland umbrellas, two shaggy manes push up from the moist forest floor along the Milk River. These mushrooms with shaggy or scaly caps on long stems are among Montana's most easily recognizable edible species. Often found in the fall under urban hardwood trees and along old logging roads, they taste best picked young and cooked quickly after harvest.

NATHAN COOPER

MONTANA
A BEGINNER'S GUIDE TO
MUSHROOMING

Expert advice on what—and what not—to pick and eat.

BY CATHY CRIPPS

A rainstorm the previous week had produced an explosion of wild mushrooms. The forest floor was covered with fleshy fungi of all shapes, sizes, and colors: Frilly orange vases, bumpy white orbs, intricate yellow corals, and meaty purple monsters stood shoulder to shoulder. These wild mushrooms grabbed my attention: What were they, and, more importantly, were they edible?

That was 50 years ago, while I was living in a small cabin high in the Rocky Mountains of Colorado. I was trying to live off the land, surviving mostly on venison, grouse, berries, and wild plants. I wondered: Could I add wild mushrooms to my diet without poisoning myself?

Down the road in a former coal-mining town lived many European immigrants who knew about wild mushrooms. These "old-timers," as my friends and I reverently called them, picked mostly king boletes and chanterelles, two well-known edible species. Occasionally I shadowed them to their secret spots, learning the habitats of a couple of species. I also picked up a bit from the few field guides I could find, though back then none had color photos.

Then one year a band of roving mycologists (mushroom experts) hosted a mushroom foray near my cabin. What luck! I learned a huge amount from this eclectic group and by attending their subsequent mushroom festivals in Telluride, Colorado. Ultimately, this led to a long professional career studying and teaching mycology in Montana and a lifetime of collecting, cooking, and eating these delicious wild foods.

The basics

Wild mushrooms are the fruiting bodies of fungi that sprout from soil or dead wood. Sustaining the mushrooms are networks of underground threadlike mycelium, which extract nutrients from soil and plants.

The best way to learn about wild mushrooms is to go out with an expert or, better yet, a group of experts. Second best is to consult regional field guides. The worst way is by trial and error, what I call "mushroom roulette." Some people will cook almost any wild mushroom they find and, if it tastes good, figure it's safe. Bad idea. It's just a matter of time before they consume the "loaded chamber" and get sick, or worse.

Many wild mushroom species can cause severe stomach upset or other gastronomic problems. A few species are deadly. To learn how to safely harvest delicious wild mushrooms in Montana, stick with the popular edible—and easy-to-identify—species and

Cathy Cripps is a mycologist and professor of plant sciences and plant pathology at Montana State University in Bozeman. She is the lead author of The Essential Guide to Rocky Mountain Mushrooms by Habitat.

learn to avoid the most inedible and toxic ones, the most dangerous of which we've included in this guide (page 32).

When and where to go

Timing and location are key to finding wild mushrooms. Though there are hundreds of species, each with unique habitats, all mushrooms sprout for a day to a week after a rain, making wet periods and wet places the most productive times and sites for foraging.

The best seasons are spring and fall, when rains are most common. May through June is usually a reliable period to hunt for morels and oyster mushrooms. Summer is often too dry for mushroom sprouting, though shaggy manes and giant western puffballs can show up in June and July, and black morels (especially the fire varieties) can be found at high-elevation burn sites as late as August, especially on north-facing slopes. For most species, however, it's not worth looking during the heat of summer or in a drought like we had in 2020. Last year the spring weather was so dry in southwestern Montana that mushroom season was over by the end of May.

Favorable mushroom weather returns in late August if the area you're in receives late-summer rains. With enough moisture, early autumn is the time for chanterelles, king boletes, and several other varieties. These sprout first at lower elevations, then increasingly higher over subsequent weeks.

Note that even in wet conditions, certain mushrooms sprout only during certain times of the year, such as yellow morels in spring and chanterelles in fall.

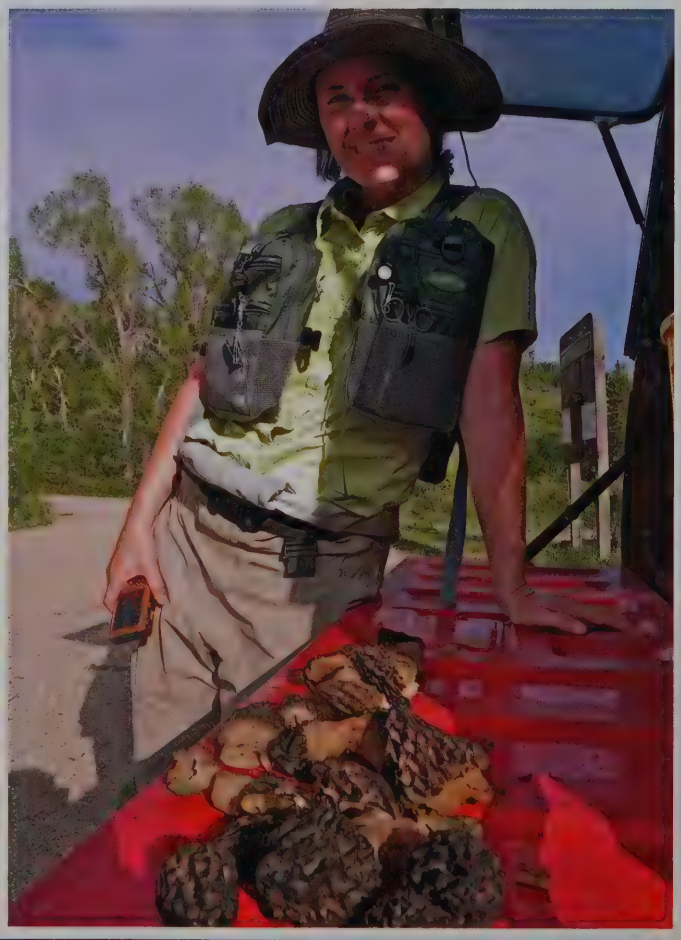
Montana has many different wild mushroom habitats: riparian corridors, aspen stands, meadows, and conifer (pine, spruce-fir, and Douglas fir) forests. Most species in this guide sprout in conifer forests.

Use a cloth or mesh bag, basket, or other open container to carry the mushrooms you collect. Mushrooms quickly spoil if you store them in plastic bags or leave them in hot vehicles. They store best in cool temperatures, so get them to a refrigerator as soon as possible. Many so-called "poisonings" have resulted from people eating ordinarily safe mushrooms that spoiled in warm storage.

Listed here are 10 common edible mushrooms and several poisonous ones. Use this article as a starting point, but also buy a regional (Rocky Mountain) mushroom guidebook or download online guides as backup to confirm your finds.

Note that very few species in Montana are deadly, but many can cause an upset stomach. Some people react even to the popular edible mushrooms listed here, so if you've never consumed a species before, eat only a small portion the first time to see how you react. Also note that all wild mushrooms should be thoroughly cooked.

And always remember: When in doubt, throw it out.

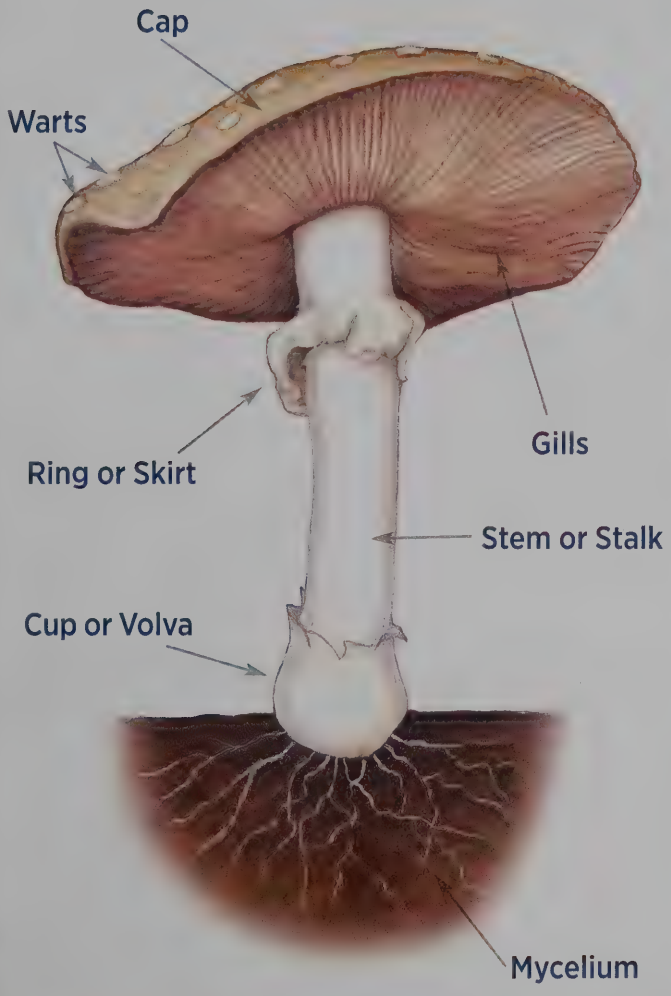


BOUNTY HUNTERS Above left: Shaggy manes pop in the fall. Young ones, like these in the Gravelly Mountains, should be cooked soon after harvest. The inedible older specimens drip an inklike liquid from their cap, making them easy to identify. Above right: A haul of black non-fire morels harvested in early June in the Snowy Mountains. Black morels can be gray, brown, or black, but all have black ridges. Black "burn" morels sprout the year after a forest fire. Look for them on the perimeters of burn sites, where red conifer needles litter the forest floor.

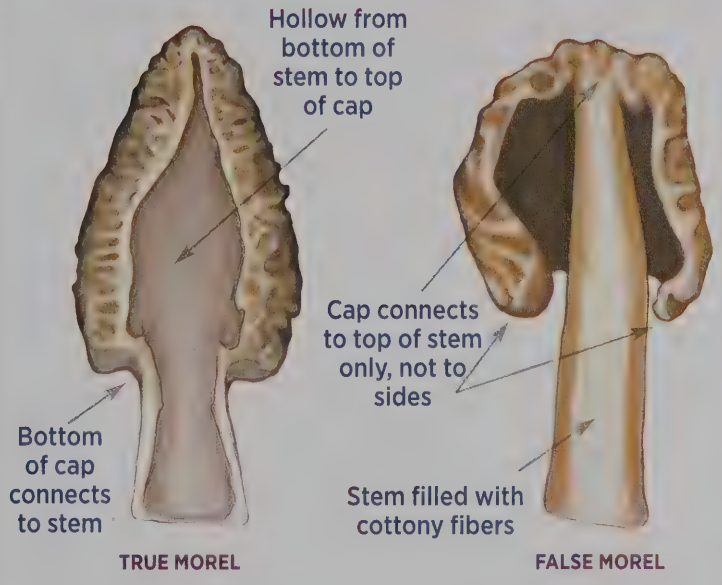
LEFT TO RIGHT: LESTER KISH; DAVE RUMMANS

Mushroom anatomy

The most common mushrooms have a stem supporting a cap, with gills underneath. This "gilled" mushroom category contains the poisonous *Amanita* species (page 32). Only one of the edible mushrooms in this guide, the shaggy mane (page 31), has gills.



TRUE MORELS

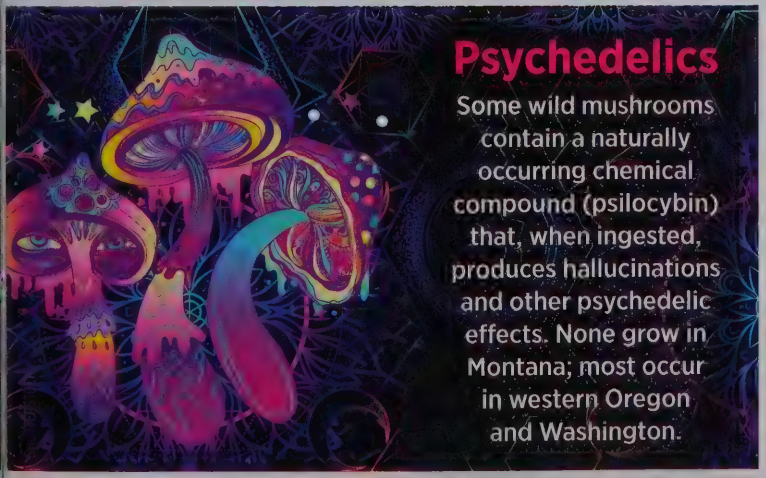

Hollow from bottom of stem to top of cap
Cap connects to top of stem only, not to sides
Bottom of cap connects to stem
Stem filled with cottony fibers
TRUE MOREL
FALSE MOREL

SCIENTIFIC ILLUSTRATIONS: LIZ BRADLEY
TRUE MOREL: ERIC HEIDLE. FALSE MOREL: SHUTTERSTOCK

True or false morel?

To make a positive identification, cut the specimen in half lengthwise. The cap of a true morel mushroom attaches directly to the stem from top to bottom, like a hollow chocolate bunny. The cap of a false morel attaches only at the very top and hangs down over the stem like a folded umbrella.

FALSE MOREL



Psychedelics

Some wild mushrooms contain a naturally occurring chemical compound (psilocybin) that, when ingested, produces hallucinations and other psychedelic effects. None grow in Montana; most occur in western Oregon and Washington.

10 popular edibles

Listed from earliest to latest in the year.

Oysters

Oyster mushrooms

Pleurotus species

Montana is home to two types of edible oysters: the grayish-brown *Pleurotus pulmonarius* that grows on cottonwoods and the white *P. populinus* found on aspens. Both grow in riparian areas in large clusters on logs or standing dead trees—hence the nickname "stumpies"—from May through June, then in early fall if conditions are wet. The stem is attached to one side of the oyster-shaped cap, and the cream-colored bladelike gills run down the short stem. The flesh of oyster mushrooms is soft and often consumed by insects before human harvesters can get to them.

Yellow morels

Morchella americana

These pale blond beauties fruit in spring under cottonwood trees along stream- and riverbanks and islands. Start hunting for yellow morels when the leaves on neighborhood lilacs reach the size of rabbit ears. The pine cone–shaped cap varies from gray to yellow brown and is covered with pits and ridges. Like all true morels, the cap edge is attached to the stem and the interior is completely hollow. Morels grow in patches, so if you find one, stop, squat, and look around; there are likely more nearby. Cut them in half lengthwise to check the interior for any small insects, which can be whisked out with a toothbrush.

Yellow morel

Black morels

Black morels

Morchella species

Several types of black morels grow in Montana. Though the caps of black morels can be gray, brown, or black, the mushroom's black ridges, which consistently darken with age, give them their name. Black morels resemble pine cones, making them frustratingly difficult to find in the conifer forests where they grow. As with yellow morels, the edge of the cap joins to the stem, making one big hollow inside.

Black "burn" morels (*M. septimelata, M. tomentosa*) come up one year after a fire on burned soil, sometimes fruiting in great abundance in June and July, especially after rains. Search the edges, where burned areas mix with unburned ones in a black-green mosaic, and where red conifer needles cover the ground.

Natural (non-fire) black morels (*M. brunnea, M. snyderi*) are found scattered in unburned forests and gardens from spring to summer. They are similar to burn morels but are usually brown.

Some people get sick after eating morels, especially the black varieties. Some people get sick if they consume wine with yellow or black morels.

Giant western puffballs

Calvatia booniana

These large, white, solid orbs, ranging in size from softballs to volleyballs, have flat scales on top and are easy to recognize. Not all puffball mushroom species are edible, but these giants are tasty when young and pure white inside with a soft texture. Once the interior yellows even a bit, they develop an off odor and taste, and can produce an upset stomach when consumed.

Giant western puffballs fruit in open meadows and sagebrush prairies statewide in late June and July, and can be seen from roadsides. Most mushroomers cut the soft flesh into slices, which are then coated with flour, beaten egg, and bread crumbs and sautéed in butter, like you'd cook an eggplant. A single large specimen can feed a family. Like morels, giant western puffballs can be dried, stored in an airtight container, and reconstituted later in hot water.

Avoid small puffballs the size of a golfball or smaller, which could be the button stage of the toxic fly agaric *Amanita* mushroom (see page 32).

Western puffball

King boletes

Boletus edulis

"Kings" are among Montana's largest mushrooms. The caps can grow to the size of a dinner plate (though most are saucer-size) and are the color and shape of a nicely browned hamburger bun. Underneath the cap is a spongy layer of pores that turn from white to yellow as the mushroom ages. The fat white

CLOCKWISE FROM TOP LEFT: NATHAN COOPER; DAN ELLISON; NATHAN COOPER; NATHAN COOPER

King boletes

stem has small veins at the top and is edible.

Note that these mushrooms attract insects and worms, so cut off any infested portions before consuming.

Avoid any boletes with red pores on the underside of the cap. These are the toxic bolete species.

Rainbow chanterelles

Cantharellus roseocanus

Also known as yellow or golden chanterelles, these frilly, vase-shaped mushrooms have ridges (not true gills) running down the stem, an apricot color, and a fruity aroma. They can go unnoticed because they often lie flat to the ground. These sturdy, hard-fleshed chanterelles grow in patches, so if you find one, others will likely be nearby. Hunt for them during a wet August and September in conifer forests, though they can appear earlier at lower elevations. Be cautious of inedible or poisonous look-alikes such as the false chanterelle (*Hygrophoropsis aurantiaca*), which, though vase shaped, is much softer and flimsier and has true gills.

Rainbow chanterelles

Hawkwings or scaly urchins

Sarcodon imbricatus

The common names say it all. These large, fleshy, brown mushrooms are covered with darker brown scales. Tiny "teeth" under the cap clinch the identification. This fungus forms large rings in conifer forests in late August and September and can be collected by the bushel. Older specimens taste bitter to some people, but young ones, with their strong (and, to many of us, delicious) flavor, are favored in spaghetti sauce and other dishes calling for firm-fleshed mushrooms. Beware of bitter-tasting look-alikes.

Hawkwings

Shaggy manes

Coprinus comatus

These tall "inky-caps" have white, shaggy or scaly caps on long stems, resembling a closed umbrella. Easily recognizable are older specimens, which drip inklike liquid from their cap. At this stage they are no longer edible, but when picked young and cooked quickly after harvest—they deteriorate overnight in a refrigerator—they are a great addition to scrambled eggs or sauces.

Look for them in the fall along old logging roads or bordering paved roadways, at the base of urban hardwood trees, or under neighborhood shrubbery. Eat only those from areas free of pesticides, herbicides, and heavy vehicle exhaust.

Shaggy manes can leak their inky liquid during transport, making a mess of collecting equipment and clothing, so be careful.

Note that shaggy manes can resemble the poisonous tall, white *Amanita bisporigera* (destroying angel), so be extra cautious with these.

Shaggy manes

Sweet tooths

Sweet tooths or hedgehogs

Hydnum repandum

The pale apricot caps of these mushrooms look like those of chanterelles but have tiny white "teeth" below rather than ridges.

They sprout in conifer forests from August through October. The flesh is brittle and requires care when collecting and cooking. Their unique, delicious flavor makes them one of my favorites.

Branched bear's head

Branched bear's heads

Hericium coralloides

Long white icicles hang from branches, all of which is edible. When cut up the texture is somewhat like crab meat, and when cooked with lemon and dill the seafood resemblance is enhanced. Branched bear's heads sprout in late spring in riparian areas on fallen aspens and cottonwoods. ■

CLOCKWISE FROM TOP LEFT: CATHY CRIPPS; CATHY CRIPPS; SHUTTERSTOCK; SHUTTERSTOCK; LESTER KISH; CHANCE NOFFSINGER

Toxic mushrooms

Amanita species

Anyone who collects wild mushrooms should learn to recognize the *Amanita* species because some are deadly. The most poisonous ones grow along the West Coast, but Montana is home to the pure-white *Amanita bisporigera*, known as the **two-spored destroying angel** (not shown). This species is extremely rare in Montana and it's unlikely you will ever come across one.

All *Amanitas* have a cup (called a volva) or rings of tissue at the base of the stem (see illustration, page 29). Some have a ring on the stem or patches of tissue (warts) on the cap, or both. The two most common *Amanitas* in Montana are the:

• **Fly agaric** *(Amanita muscaria,* yellow var.)

This pretty-but-toxic *Amanita* has a yellow cap with whiteish warts, a ring on the stem, and three rows of tissue near the stem base. While not deadly, fly agarics can cause serious poisonings that have sent people to the hospital. They can cause delirium and hyperactivity when eaten, followed by comatose sleep. Fly agarics show up in aspen and conifer forests in the fall.

Fly agaric

Panther

• **Panther** *(Amanita pantherina)*

The panther is another pretty *Amanita* and looks like the fly agaric. It has a tan to dark brown cap with white patches, a ring on the stem, and a distinct cup at the base. It contains the same poisons as the fly agaric and causes the same uncomfortable symptoms from which, fortunately, most people recover after 12 hours. It is a summer and fall mushroom found in conifer or mixed forests.

Funeral cap

Generic little brown mushrooms

Galerina marginata, for example

You'll see many of what I call "LBMs" in forests, along trails, in mulch beds, and in lawns. Many are harmless, but a few can be deadly. One is *Galerina marginata,* or funeral cap, which contains the same serious liver-destroying toxins as some *Amanitas*. These little mushrooms have a greasy ocher cap and a ring on their slim stem. They show up any time of year in moss or mulch.

Brain or walnut mushrooms

Gyromitra esculenta

This "false morel" has a wrinkled red-brown cap that looks like a brain or a walnut perched on a hollow stem. It can be deadly because, after consumption, a person's stomach produces monomethyl hydrazine (rocket fuel). The effect is cumulative, and if a sufficient quantity is consumed over time, the liver is destroyed. It fruits in conifer forests in late spring.

Brain mushroom

Thimble false morels or verpas

Ptychoverpa bohemica

These look even more like morels, but the caps have longitudinal wrinkles and not pits and ridges. The margin of the cap hangs free from the white stem, unlike a true morel, on which the stem and cap are one complete unit. While not deadly, this mushroom can cause gastronomic troubles in some people. Though the toxin is volatile and can be boiled off, it's still not a good idea to eat any of these. Note that they sprout in the same season and habitat as yellow morels.

Thimble false morel

Rough-stalked boletes

Leccinum aurantiacum

Also called orange caps, these large boletes can be mistaken for kings, although they are found mostly in summer under aspens rather than conifers. Caps are orange to reddish brown, with a spongy layer underneath, like all boletes. The substantial whiteish stems are covered with shaggy brownish-black scales. When cut open, the flesh inside turns pink, blue, gray, or black. Though listed as edible in some field guides, there have been numerous cases of poisonings, often when people ingested raw or undercooked specimens. They are best avoided. ■

Rough-stalked boletes

CLOCKWISE FROM TOP LEFT: SHUTTERSTOCK, SHUTTERSTOCK, CATHY CRIPPS, SHUTTERSTOCK, SHROOMERY OPPOSITE PAGE: SHUTTERSTOCK

Cooking wild mushrooms

Preparation: Stems of most species are edible, but you need to trim the bottom of stems to remove dirt. Check for maggots, worms, or other tiny critters and brush away. If the mushroom is infested with too many, discard. Refrigerate the mushrooms you don't cook. They store well in cool conditions for a week.

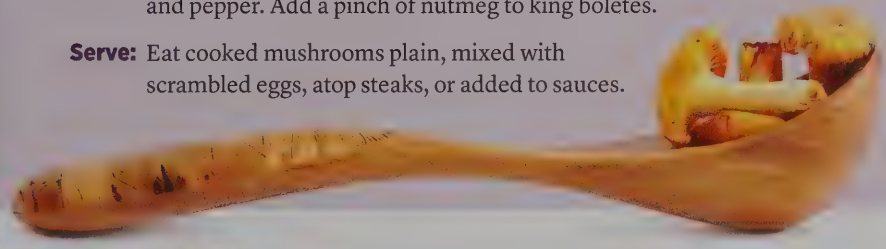
Sauté: This is the easiest and most popular way to cook mushrooms. Sauté in a good amount of butter or olive oil or a mixture of the two. Cook so the mushrooms aren't touching each other. Mushrooms are mostly water, and crowding ends up steaming rather than sautéing them. Some people add a little minced garlic, thyme, or both during the last few minutes of the sauté.

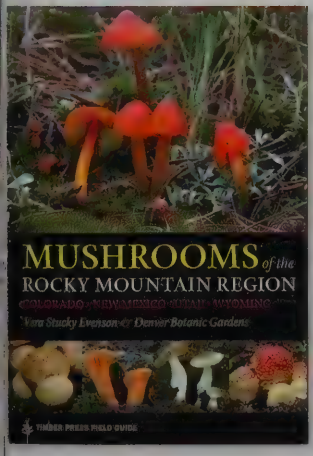
Roast: Toss mushrooms in olive oil, salt, and pepper and roast in a pan at 400 degrees F for about 20 minutes.

Fry: Some people like to dip mushrooms in flour, beaten egg, then bread crumbs and deep-fry them in oil.

Season: Like steak, cooked mushrooms taste best with a hearty dose of salt and pepper. Add a pinch of nutmeg to king boletes.

Serve: Eat cooked mushrooms plain, mixed with scrambled eggs, atop steaks, or added to sauces.




MUSHROOMS of the
ROCKY MOUNTAIN REGION
COLORADO · NEW MEXICO · UTAH · WYOMING
Vera Stucky Evenson & Denver Botanic Gardens
TIMBER PRESS FIELD GUIDE

Learn more

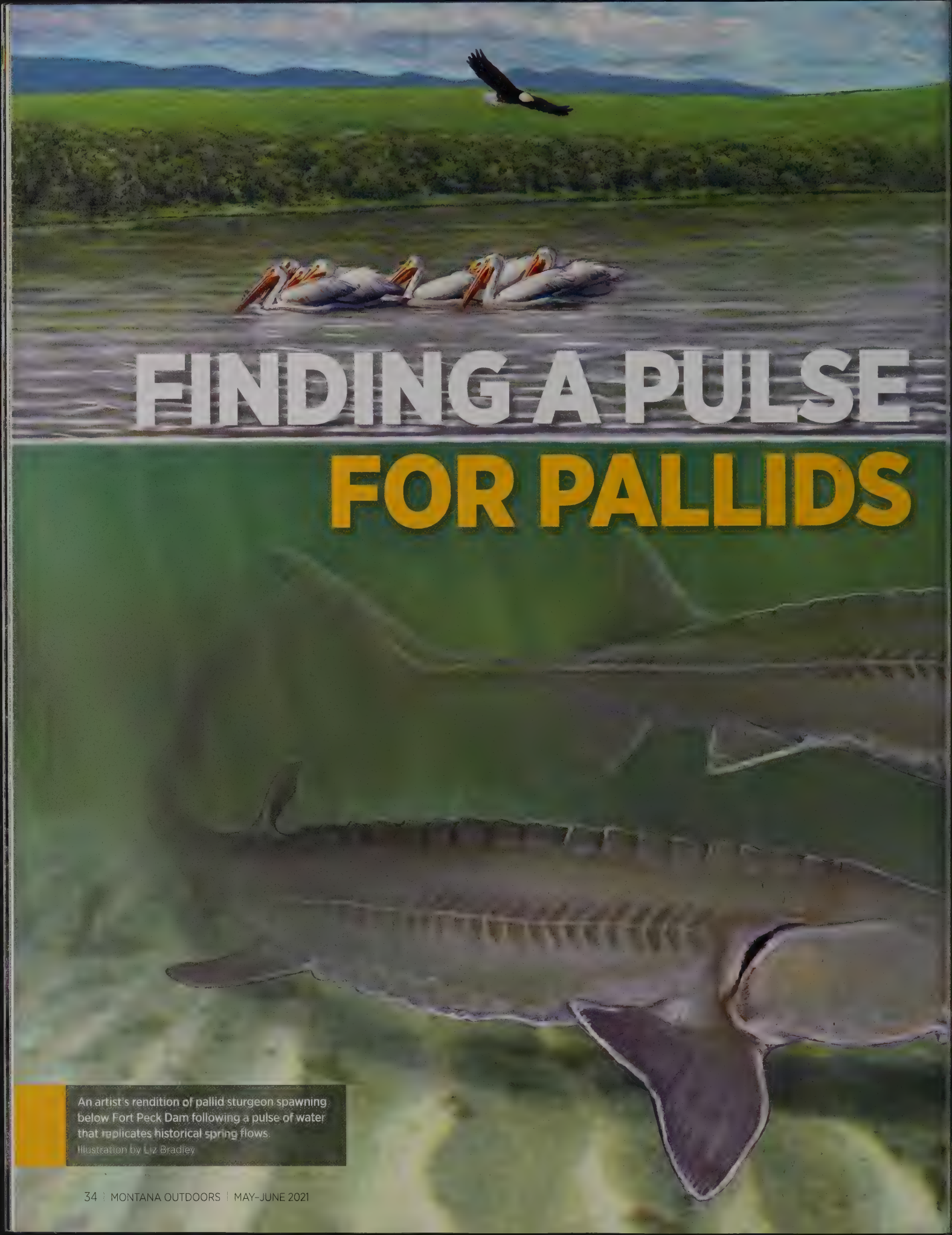
GROUPS: The best way to learn to identify mushrooms is with experts from the Western Montana Mycological Association (facebook.com/montanamushrooms) or the Southwest Montana Mycological Association (ccripps@montana.edu). Both sponsor seasonal mushrooming forays, though SMMA forays are cancelled for 2021.

BOOKS: *Mushrooms of the Rocky Mountain Region*, by Vera Evenson; *The Essential Guide to Rocky Mountain Mushrooms by Habita*t, by Cathy Cripps, Vera Evenson, and Michael Kuo.

MUSHROOM ID: You can send or bring strange or suspected toxic mushrooms to the Schutter Plant Diagnostic Lab at Montana State University in Bozeman for identification. (406) 994-5150; diagnostics@montana.edu.

10 wild mushroom safety tips

1. Before consuming any wild mushroom, be sure you identify the species and know it's safe to eat.
2. Never eat wild mushrooms raw; always cook them thoroughly.
3. Be especially careful if out with children. Instruct them never to eat a raw mushroom. Dogs can be sickened too.
4. Don't overindulge; eating too many mushrooms can cause an upset stomach.
5. Don't collect old, dried mushrooms. They won't taste good.
6. Always store mushrooms in cool, dry, dark conditions.
7. Morels give some people an upset stomach; test by eating a small cooked portion before ingesting any more.
8. Some people get an upset stomach if they consume wine with morels or shaggy manes.
9. The best way to positively identify gilled mushrooms is by taking a spore print. Lack of space prevents explaining here, but you can find information online.
10. If you suspect someone has been poisoned by a mushroom, call the Rocky Mountain Poison & Drug Safety (RMPDS) at (800) 222-1111.



FINDING A PULSE FOR PALLIDS

An artist's rendition of pallid sturgeon spawning below Fort Peck Dam following a pulse of water that replicates historical spring flows.
Illustration by Liz Bradley

Why a brief surge from Fort Peck Dam mimicking natural spring runoff could help restore life to Montana's rarest fish species. BY ANDREW McKEAN

When built in the 1930s, Fort Peck was the world's largest earthen dam. After the 4-mile-long structure impounded the Missouri River, it blocked upstream movement of native fish. If water conditions allow, a proposed 2022 test would send flows over the spillway (shown here during low water) to trigger spawning activity downstream that would aid young pallid sturgeon development.

Hulking Fort Peck Dam, built with muscle and steam shovels during the 1930s, has been called a marvel of modern engineering, a Depression-buster, and the engine of a recreational economy that has sustained eastern Montana for three generations.

The 4-mile-long earthen dam that created Fort Peck Reservoir could also be called a fish killer for blocking the spawning runs of a dozen native species that moved hundreds of miles up and down the Missouri River for millennia. Now, decades after Fort Peck Dam's construction, the dam is set to play an outsized role in the recovery of at least one of those species.

This time next year, if water levels are high enough, the U.S. Army Corps of Engineers—which operates the dam—will release a brief surge of water from the reservoir into the Missouri River. The proposed 2022 test would be the first of many to be conducted in coming years. The aim of these experiments is to mimic natural spring runoff conditions that pallid sturgeon and other native fish require for what fisheries biologists call "recruitment": the advancement from eggs into young fish into older fish that "recruit" to the population to produce young of their own. If this flow test succeeds in provoking what scientists call a "spawning event," it could signal a new approach for recovering one of the most imperiled fish species in the United States. It could also help native game species like channel catfish, sauger, and paddlefish, as well as blue suckers, sicklefin chubs, and other seldom-seen fish that evolved in the once-free-flowing Big Muddy.

Long as a broom handle, pallid sturgeon are prehistoric fish that evolved over millions of years in free-flowing prairie rivers like the Missouri and lower Yellowstone. They were listed as federally endangered in 1990 because of plummeting populations and little ability to reproduce naturally in the dammed river. If the Missouri's remaining wild pallids respond to Fort Peck's proposed 2022 spring spill and manage to spawn and develop, then fisheries managers may see a path to recovering the species and a new way to manage the river's flows for a few days every several years. "The potential is huge," says Eileen Ryce, Montana Fish, Wildlife & Parks fisheries chief. "If this works, it would be the most important development to help pallids that we've ever seen."

If pallids don't respond, the game isn't over; scientists will keep searching for ways to enhance wild pallid sturgeon recruitment.

In the meantime, the population will continue to rely on what amounts to fisheries CPR: stocking young pallids grown in hatcheries to sustain remnants of the ancient species. Hatchery fish are better than nothing, but for the pallid sturgeon to ever be considered recovered under the Endangered Species Act, fish must be able to reproduce on their own. "It's not enough to just stock pallids and use the river as an aquarium," says Tyler Haddix, FWP pallid sturgeon biologist. "We are using hatchery fish only to make up the void in recruitment over the past half century. If we get the hydrology and the habitat right, we're hoping the wild fish will be able to do that on their own."

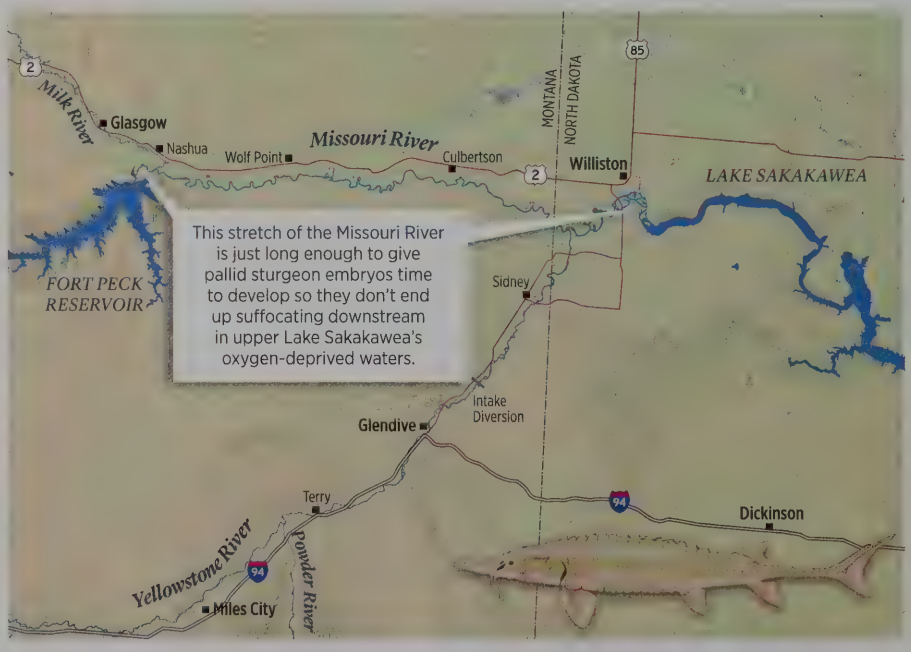


PHOTO: USACE, OMAHA DISTRICT; MAP ILLUSTRATION: LUKE DURAN/*MONTANA OUTDOORS*

Andrew McKean is the hunting editor of Outdoor Life *and a longtime contributor to* Montana Outdoors. *He lives on a ranch near Glasgow.*

DUST-COUNTRY HYDROLOGY

Understanding the pallid's plight requires a quick course in how the big rivers of the northern Great Plains guided the species' evolution. Like their cartilaginous cousins the shovelnose sturgeon and the paddlefish, pallids need muddy, slow, free-flowing rivers with plenty of nutrients like larval insects and small fish. They also require high water in June to cue upstream movement. In fact, their torpedo-shaped bodies evolved to navigate heavy springtime flows and reach upstream spawning sites, generally underwater sand dunes next to slower-moving channels.

Construction of Fort Peck Dam as well as Garrison Dam in North Dakota put a roadblock on those long spawning runs. At the same time, hydropower management replaced heavy spring pulses of turbid, warm runoff with steady flows of cold, clear water from the reservoir bottom. While that prevented downstream farms and towns from flooding, it removed the pallids' seasonal spawning cues. The relatively few wild pallid sturgeon in the Yellowstone and Missouri rivers above Lake Sakakawea in western North Dakota have not successfully recruited young to the population since the mid-1950s.

That reproductive drought is due mainly to the threat the reservoir poses to newly developing baby sturgeon. When sturgeon spawn, the fertilized eggs hatch into free-floating embryos that drift downstream hundreds of miles, feeding off their attached yolk sac. After one to two weeks, the quarter-inch embryos, which resemble tiny tadpoles, grow into 1-inch, free-swimming larvae that look much like miniature versions of adult sturgeon. At this point the tiny fish have used up their yolk sac and can now feed on tiny aquatic insects with their newly developed mouth. Even more important, they have developed pectoral fins and a stronger tail, enabling them to swim.

> "It could also help native game species like channel catfish, sauger, and paddlefish, as well as blue suckers, sicklefin chubs, and other seldom-seen fish that evolved in the once-free-flowing Big Muddy."

But for more than half a century, the tiny fish haven't had enough time—or, more to the point, enough river miles—to reach this stage.

A CRITICAL TRANSFORMATION

That's because, following construction of Garrison Dam in 1953, Lake Sakakawea backed water upstream nearly to Montana. Sediment and organic material accumulated where the river enters the reservoir. Recent studies have shown the sediments in this area lack enough oxygen to support sturgeon larva development.

Historically, pallid embryos had plenty of time to develop as they floated down the Missouri and Yellowstone. But with Sakakawea now looming downstream, the embryonic fish have been in a race against time to develop fast enough to swim up and out of the stagnant upper reaches of the reservoir before they sink to the bottom and suffocate.

"If we didn't have Fort Peck Dam, the adults could spawn farther upstream and give the larvae enough time to develop," says Haddix. "Or if we didn't have Sakakawea, they would have more downstream miles to develop. But having both means the larvae are boxed in and have just the bare minimum number of river miles, and only if conditions are just right."

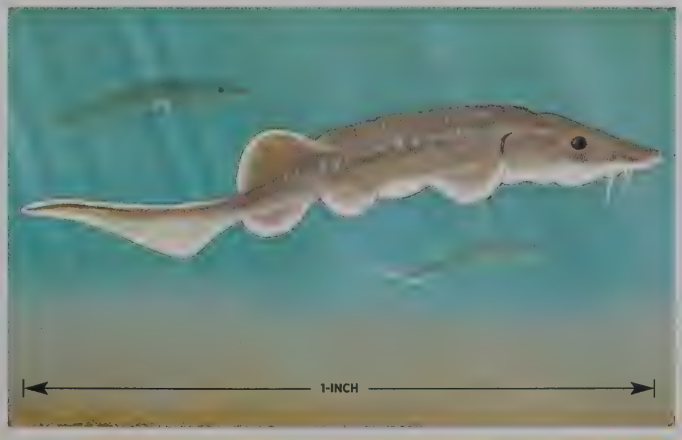
The 2022 pulse experiment aims, in part, to draw adult sturgeon closer to Fort Peck Dam to spawn, giving embryos an extra couple of days to develop.

Biologists don't have much time to help the roughly 100 wild pallid sturgeon remaining in the Missouri and Yellowstone system reproduce. These big fish—4 to 5 feet long and weighing up to 60 pounds—were all juveniles in the 1950s when Garrison Dam was built. They are now nearing 70 years old and slowly dying off. Though some hatchery pallids, first stocked as youngsters in 1998, are now old enough to spawn, the clock is ticking as biologists try ways to get the wild old-timers to reproduce before they disappear for good.

PROOF IT COULD WORK

Scientists learned a lot about pallids over the past two decades. FWP crews netted the big

WITHOUT enough time to develop, embryos floating downstream in the current sink to the bottom of upper Lake Sakakawea and suffocate in the oxygen-deprived environment.



WITH enough time to develop, embryos grow into larvae with pectoral fins and a stronger tail, enabling the miniature sturgeon to swim up and out of Sakakawea's anoxic danger zone.

ILLUSTRATIONS BY LIZ BRADLEY

fish in the lower Missouri and Yellowstone, surgically implanted radio transmitters in their bellies, then released them. Biologists then began to track movements and understand habitat preferences. Years of following the few remaining wild pallids and the new generations of hatchery-reared fish revealed that the species will move upstream only during preferred water conditions and to specific spawning sites.

In 2007, crews documented adult female pallids dropping their eggs near males close to Fairview, along the Montana–North Dakota border. That same year, they released days-old hatchery embryos about 75 miles below Fort Peck Dam and monitored their drift. That's when they learned that the Missouri from Fort Peck Dam downstream to Lake Sakakawea is just long enough to give embryos drifting downstream time to develop their pectoral fins and strengthen their tiny tails so they can kick out of the current, thus avoiding the downstream death sentence at upper Sakakawea.

> **"This proved it was possible for pallids to pull off a successful spawn if they just had enough springtime flows to trigger it."**

"Over the past 20 years, we've collected enough solid scientific data to indicate that, with the right conditions, there can be some pallid recruitment on the Missouri," Haddix says. "That work also determined that a flow test—releasing enough water that combines water from Fort Peck's turbines and spillway combined with warm, muddy Milk River water—could create conditions that pallids would respond to."

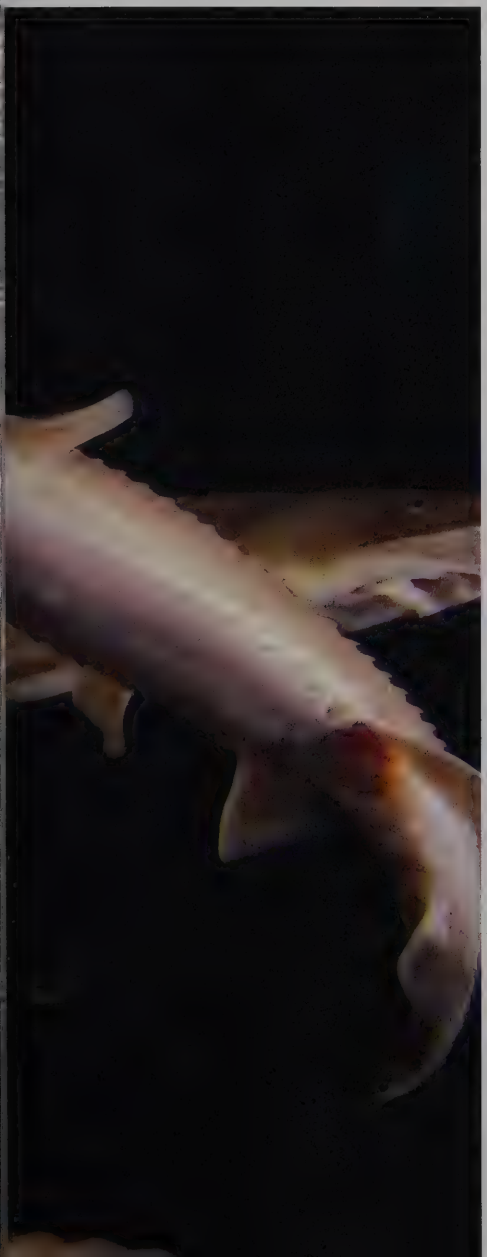
In spring 2011, nature confirmed what scientists suspected. When massive snows from the previous winter melted, the Milk River—which runs along the Hi-Line and meets the Missouri 10 miles below Fort Peck Dam—turned into a raging torrent that hydrologists labeled a "1,000-year flood event." Muddy water gushing from the Milk

BACKUP PLAN Pallid sturgeon at a federal fish hatchery show the species' wedge-shaped head, which evolved to help the fish stay close to the river bottom during heavy flows. Sturgeon hatched from eggs taken from Montana pallids and reared in hatcheries have been regularly stocked in the Missouri and Yellowstone rivers since 1998. They provide a backup for biologists working to find ways for the handful of remaining wild sturgeon to "recruit" new generations of pallids into the population, one of the nation's most endangered.

into the Missouri mimicked the historical high flows of the larger river from before Fort Peck Dam construction. Sturgeon downstream got the spawning signal and, for the first time in decades, started moving up both rivers. "We observed pallids spawning in 2011 near the mouth of the Milk," Haddix says. "Then we captured our first ever wild-produced, genetically confirmed pallid sturgeon free embryo in the Missouri River. This proved it was possible for pallids to pull off a successful spawn below Fort Peck if they just had enough springtime flows to trigger it."

In 2018, after several years of high water in Fort Peck, the Corps released warm water from the top of the reservoir over the spillway. Once again, pallids paid attention, and biologists recorded fish moving up the Missouri. Both high-water events convinced the U.S. Fish & Wildlife Service, the agency responsible for endangered-species management, to renew its interest in the Missouri and set the table for next year's historical flow test.

THAR SHE BLOWS! Massive snowmelt and heavy rains in spring 2011 forced the U.S. Army Corps of Engineers to release a record 90,000 cubic feet of water per second through the Fort Peck spillway in mid-June. Shown here: 50,000 cfs on June 11.



TOP TO BOTTOM U.S. ARMY PHOTO / DIANA FREDLUND; JOEL SARTORE

The Corps, convinced by the growing body of scientific data, agreed to the experiment, signaling a more focused approach by the agency to endangered species recovery. "Sturgeon are the most critically endangered group of fish in the world," says Steve Dalbey, FWP regional fisheries manager in Glasgow. "The Corps' proposed action is a step toward recognizing this dire fact and taking action to rectify some of the harm that dams have caused to pallid survival."

A SPIKE, THEN A PULSE

While federal and state agencies, downstream irrigators, and dam managers are still negotiating final details, the 2022 flow experiment is proceeding as planned. One major prerequisite is that the reservoir holds enough water next spring from rain and runoff to send sufficient flows over the spillway. "Otherwise the experiment won't work," says Joe Bonneau, manager of the Corps' Missouri River Recovery Program. If conditions allow, warmer surface water from Fort Peck will be released in April. This "spike" release will be a flow of 14,000 to 16,000 cubic feet per second, compared with normal spring flows of about 8,000 to 12,000 cfs. It's designed to reproduce early prairie runoff in a pre-dam system and alert downstream fish that it's time to move upstream to spawning sites. The release will also test downstream bank stability and irrigators' pumps, which can get blown out if flows are too strong.

The main event—high flows from the spillway timed to coincide with muddy June runoff from the Milk—is designed to actually trigger spawning. This June "pulse" would, for a day or two, send as much as 28,000 cfs down the Missouri. (Flows downstream at Wolf Point and Culbertson, after additional water from the Milk River and other tributaries come in, would not exceed 35,000 cfs.) Then flows from the dam would be cut to around 8,000 cfs to give embryos time to drift and develop.

Though the pulse flow will be higher than normal, it is only one-third what the river sent downstream during the 2011 flood, which peaked at 90,000 cfs, and would resemble the flows seen in 2018 (see graphic, page 40). "Hydrology modeling indicates no noticeable change in downstream operations, so people along the lower Missouri should not

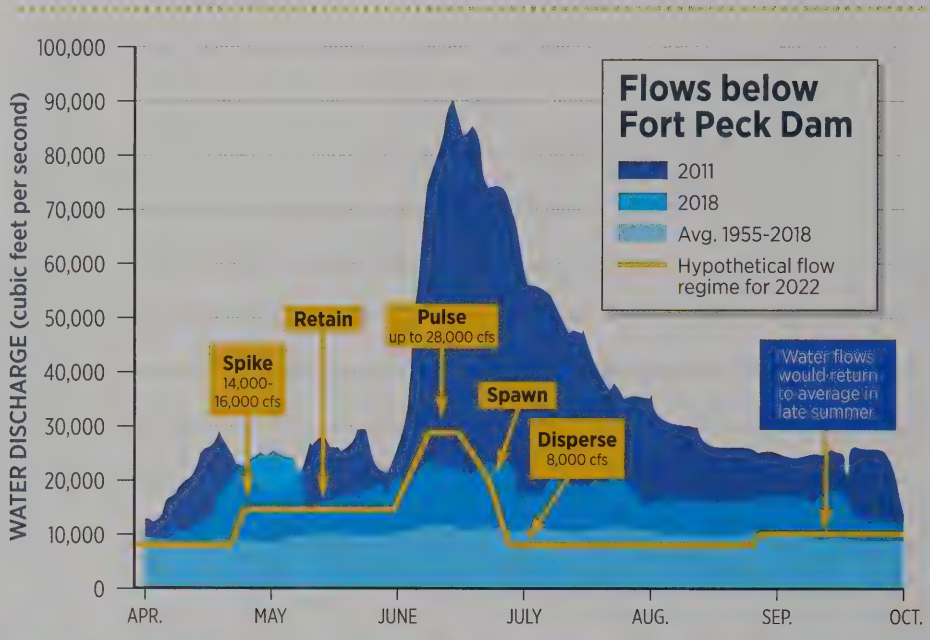
expect to see anything different from usual as a result of the test," says Bonneau.

Fisheries crews will monitor movement of pallids to spawning sites and later evaluate whether the fish laid eggs that developed into free-floating embryos. "If this works, helping with pallid reproduction may only require doing something like this periodically," Dalbey says. "Historically, pallids had successful recruitment only every several years, when hydrological conditions were optimal."

As might be expected, a plan involving one of the nation's largest rivers has raised some concerns. Irrigators on the Missouri downstream from Fort Peck Dam, especially, worry how their pumps will function in flows likely to be three times higher than Fort Peck's normal June releases. "Every irrigator lives and dies by river flows," says Dick Iverson, who grows wheat and hay near Culbertson. "During irrigation season, I'll wake up at night and make sure the gauge numbers don't move even a couple of inches, because even little bumps [in flow] can affect our pumps."

Iverson and other irrigators fear they could lose equipment to the heavy current of the test's highest flows, and that the post-pulse low flows would then strand pumps and attached debris screens in exposed mud. "If a floating pump drops down into the silt, you could lose a $3,000 screen in a matter of seconds," he says.

Over the past few years, FWP and Corps officials have regularly met with county conservation districts, irrigators, and other water users to determine how proposed flows might affect pumps and irrigation. A field review of more than 150 pump sites led to a request by FWP to raise the low flow



POSSIBLE FLOWS If water conditions allow, the U.S. Army Corps of Engineers will release a "spike" of roughly 15,000 cfs from Fort Peck Dam in late April 2022. That will signal adult sturgeon downstream to move up to the dam. Flows will remain at that level to retain the fish at spawning sites. Then in mid-June, a "pulse" of up to 28,000 cfs will be released for several days, triggering spawning activity. Flows will then drop so developing embryos can disperse downstream.

Meanwhile, on the Yellowstone...

During years of high water, pallid sturgeon also spawn on the Yellowstone River. Unlike the Missouri below Fort Peck Dam, the free-flowing Yellowstone still runs high and muddy with springtime snowmelt. But for more than a century, pallids' access to hundreds of miles of river has been blocked by a 10-foot-tall rock structure built in 1909 near Intake, just downstream of Glendive. Known as Intake Diversion Dam, it delivers water through a series of canals to sugar beet farmers and hay growers along the lower Yellowstone.

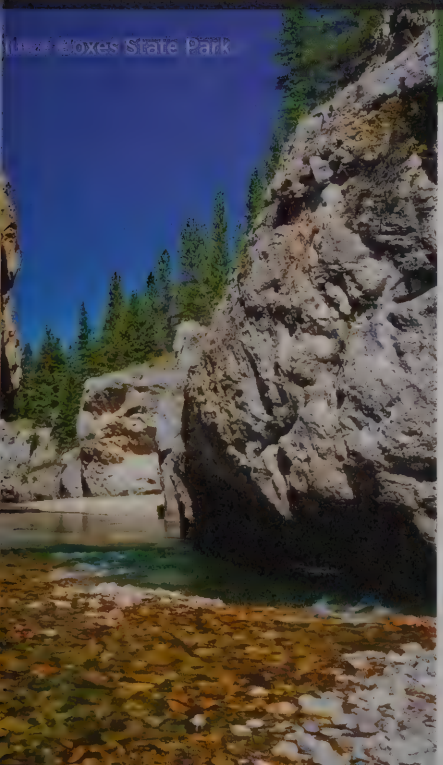
During the past several years of negotiations on the 2022 Missouri flow experiment, a concurrent project has involved rehabilitating Intake Diversion Dam so that pallids and other fish can swim past. Funded by the U.S. Army Corps of Engineers, the retrofit should also reduce "entrainment"—fish drawn into and then trapped in irrigation canals. The re-engineered structure, which includes a 2-mile-long channel that fish can use to bypass the dam, is the result of successful lawsuits demanding that the structure better accommodate pallids and other native fish.

"The fact that the Yellowstone and Missouri projects are happening at the same time is a recognition that, to pallids, it's all one big river system," says Mike Backes, FWP's fisheries manager in Miles City. "Anything we can do to improve fish passage, spawning habitat, and then larval drift distances is good for these fish, no matter which river they use."

ROADBLOCK For more than a century, Intake Diversion Dam has prevented pallid sturgeon from reaching hundreds of miles of spawning water upstream on the Yellowstone River.

U.S. ARMY CORPS OF ENGINEERS

Tyler Haddix, FWP pallid sturgeon biologist, points out that the work at Intake and on Fort Peck's flows will increase the pallids' odds of reproducing successfully. "Both projects have uncertainties regarding how well sturgeon will respond, so by doing both we have a better chance of getting fish to recruit," he says.



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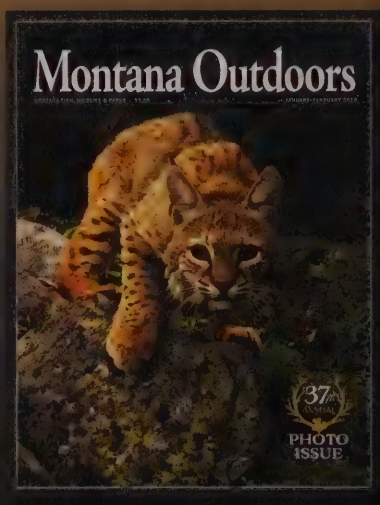

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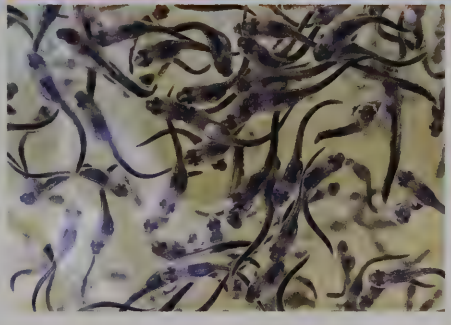
during the 2022 test from 4,000 cfs to 8,000 cfs so irrigation pumps won't be left high and dry at critical periods of the growing season. "We need to work locally if recovery actions for this fish are going to be effective in the long term," Dalbey says. "That means using the best available science on proposed flows to balance irrigation, power generation, and pallid recovery."

Zach Shattuck, FWP native fish species coordinator, says that despite all the excitement over the proposed 2022 test, it's important to view it as a learning opportunity, not a silver bullet. If native fish respond favorably, agencies have another management tool that not only helps recover the endangered sturgeon but also improves populations of other native big-river fish species. "But that one flow test won't save the pallids," Shattuck says. "We're hoping it gives us a better understanding of how we can help rivers function more naturally. As part of that, maybe we can find ways of managing the river that allow pallid sturgeon to reproduce."

Editor's Note: Opportunity for public comment on the draft Environmental Impact Statement for the Fort Peck pulse test is open until May 25, 2021. To view the EIS and comment, type "Draft EIS for Fort Peck Dam test" into an online search engine.

MIMICKING NATURE Above: FWP pallid sturgeon biologist Tyler Haddix with a hatchery-reared fish that spawned in 2018. If all goes according to plan, the pulse experiment next spring will encourage wild sturgeon to move up the Missouri River close enough to Fort Peck Dam to spawn. That way embryos (below left) that develop from eggs will have enough river miles to develop into larvae as they drift downstream, then into juvenile sturgeon (below right) that "recruit" into the population and become adults that begin reproducing.



Following Number 36

So few adult pallid sturgeon remain in the lower Missouri and Yellowstone rivers that the fisheries biologists and technicians who study them are familiar with each individual fish. These 100 or so wild adults carry radio transmitters that allow crews to follow them for years.

That's how biologists know so much about Number 36, a female pallid that may have hatched before Garrison Dam was built nearly 70 years ago. Her movements, relayed to fish biologists over the years through her coded transmissions, show how interconnected the Yellowstone and Missouri systems are, and how selective pallids can be about seeking spawning habitat.

"In spring 2014, she went up the Yellowstone, up the side channel of Intake [Diversion Dam], and then upriver to the mouth of the Powder River," says Mike Backes, FWP's southeastern region fisheries manager. That's about 240 river miles above the confluence of the Yellowstone and Missouri rivers. "We assumed she spawned a few miles up the Powder because, when we netted her, she had lost the sort of weight we see in post-spawn females," Backes says.

In spring 2018, Number 36 took a different route, up the Missouri, navigating 180 miles of river to spend two weeks in the spillway channel below Fort Peck Dam. "We're not sure why, but she didn't spawn there," Backes says. Instead, she turned around and swam downriver and spawned near the confluence of the Yellowstone. "She demonstrated that, when conditions are right, pallids will use both systems to the extent possible," Backes says.

In 2020, biologists moved the sturgeon up and over Intake Diversion Dam to see how far the fish would travel and if she would spawn. Number 36 headed upstream and, based on body weight loss, spawned around Miles City and again about 20 miles downstream.

How this mobile pallid will respond to next year's proposed Fort Peck flow test is anybody's guess. "These adult wild fish are geriatrics," says Backes. "On the one hand, that's a problem because they're old and, historically, most spawn only every other year. On the other hand, it's a good thing, because if they weren't so long-lived they'd all be gone by now."

IT'S NOT EASY BEING GREEN

Montana's amphibians have not escaped the die-offs plaguing much of the world. But some species are getting a boost from actions by tribal, state, and other wildlife programs. BY JULIE LUE

Art Soukkala searches for leopard frogs on the Flathead Indian Reservation.

The cows watch curiously as Art Soukkala, wearing hip waders and carrying a long-handled net, stalks the edge of their pasture, on the Flathead Indian Reservation near Lonepine, about 30 miles west of Polson. A wildlife biologist with the Confederated Salish and Kootenai Tribes (CSKT), he is here on this late summer day with the landowner's permission to search for northern leopard frogs. Until recently, the amphibians had not been seen in this part of Montana for decades.

CLOCKWISE FROM TOP: BRIAN TORNABENE; JULIE LUE; JULIE LUE

WHERE DID THEY GO? Northern leopard frogs are common in Montana east of the Continental Divide. But for reasons unknown, the 3.5-inch amphibians have all but disappeared from the west side of the Divide. Until a recent introduction at two sites, the species had not been seen on the Flathead Indian Reservation in years, despite abundant streams, ponds, marshes, and other typical habitats.

Within minutes, Soukkala pounces, then holds up a tiny frog the color of sagebrush, with round, sticky pads on its toes. Its body is scarcely longer than a thumbnail. "Pacific tree frog," Soukkala says. "At first I thought it was a grasshopper." He releases the small frog, and five minutes later, he's found another, sizably bigger one.

Though well-camouflaged among the plants, in hand this larger frog is vividly marked. Its body is white below and brownish-green above, with two pale ridges down the back and rows of dark, oval blotches surrounded by lighter halos—leopard spots.

"Young-of-the-year," says Soukkala. It's a northern leopard frog.

Thanks to a tribal reintroduction effort that began in the early 2000s, northern leopard frogs are not only surviving here but also breeding and moving into new areas.

The success of this frog-friendly project and other efforts to protect and improve habitat in western Montana may signal that, despite abundant bad news for amphibians, there's something we humans can do to help.

SMALL BUT MIGHTY

With its high mountains, semiarid plains, and long, cold winters, Montana is not the most hospitable place for amphibians. It's home to relatively few native species: four salamander species and nine frog and toad species. Yet these small animals play a key role in ecosystems across the state. They can be found in a wide variety of habitats, from forests to prairies, mountains to valleys, beaver ponds to backyards.

Amphibians live a "double life" (from the Greek word *amphibios*), both in water and on land—think tadpoles turning into frogs. They are also cold-blooded, what scientists refer to as "ectotherms."

"As ectotherms, amphibians are super important for channeling energy up the food chain," says Bryce Maxell, program coordinator of the Montana Natural Heritage Program and a co-author of *Amphibians and Reptiles of Montana*. "Amphibians gain energy from the aquatic environment as tadpoles and transfer that energy to the terrestrial environment when they metamorphose and are eaten by predators. They don't burn calories the way birds or mammals do, and they use every bit of energy that goes into them to increase their body mass."

TROUT FOOD Pacific tree frogs are tiny amphibians native from western Montana to the Pacific Northwest as far north as southern Alaska. The species seems particularly vulnerable to predation by trout introduced to ponds, lakes, and streams.

NOWHERE TO HIDE Worldwide, amphibians are disappearing faster than any other group of animals. In North America, threats include habitat loss and degradation, pesticides, non-native predators such as bullfrogs, and, most damaging, an infectious disease caused by the chytrid fungus. "We've even found the fungus in the center of the Bob Marshall Wilderness," says one expert.

In other words, it takes less food to grow a pound of frog or toad than a pound of mammal or bird. In turn, amphibians provide an important food source for everything from great blue herons to bobcats, even humans.

Amphibians, which absorb both air and water through their porous skin, also are important indicator species, according to Montana Fish, Wildlife & Parks nongame wildlife biologist Torrey Ritter. "If environmental contaminants are entering a system, or if a changing climate is affecting certain aquatic habitats, or if some other not-so-obvious disturbance is occurring, then amphibians will be one of the first species to be affected," he says. "They act as an early warning system, giving scientists and policymakers time to respond before the disturbance gets out of control."

Julie Lue is a writer in Florence.

THREATS GALORE

Amphibians are the most endangered group of animals on the planet. Since the 1970s, they have suffered massive die-offs worldwide due to habitat loss and degradation, pollutants like pesticides and herbicides, non-native predators, roads, and, perhaps most importantly, an infectious disease caused by the chytrid fungus.

The fungus, which attacks the animals' skin, has spread to every continent except Antarctica. One reason is the use of live African clawed frogs exported around the world for human pregnancy testing in the 1930s through 1950s. Another is the proliferation and spread of the American bullfrog. Bullfrogs, which are less susceptible to the fungus's ill effects, transmit the disease to more vulnerable species.

"No water body is safe from the fungus," Maxell says. "We've found it even in the center of the Bob Marshall Wilderness, one of the farthest places you can get from a road."

Amphibian populations in eastern Montana are still doing fairly well, according to Maxell. So far, they have managed to adapt to warmer temperatures and earlier springs caused by climate change.

But in western Montana, western toads and northern leopard frogs have suffered dramatic declines since the 1970s. Though the toads remained fairly widespread, extensive surveys of Montana water bodies between 2000 and 2007 found them in only 1 to 2 percent of breeding sites. And west of the Continental Divide, northern leopard frogs were found only in two places near Kalispell and Eureka.

LEOPARD FROGS COME HOME

Dale Becker, CSKT Tribal Wildlife Program manager from 1989 until his retirement in early 2021, says that after successfully reintroducing peregrine falcons to the Flathead

NATHAN COOPER

Reservation, he and his team considered whether they could return any other native species that had disappeared. Northern leopard frogs fit the bill. They had not been seen on the reservation since 1980, but records showed they were fairly common in the Mission Valley in the 1970s. Becker also recalled conversations with tribal elder Charlie McDonald, who grew up on the reservation in the early 1900s: "He told me about these frogs that he never saw or heard anymore."

Then in 1993 herpetologist Kirwin Werner walked into Becker's office. A graduate of Cut Bank High and Carroll College, Werner had returned to Montana after retiring from teaching herpetology at Northern Michigan University. He and his wife settled outside of Ronan, where he began teaching at the Salish Kootenai College and would later serve as the senior co-author of *Amphibians and Reptiles of Montana*. Werner asked if there were any projects he could work on.

Werner, former CSKT wildlife biologist Janene Lichtenberg, and Soukkala began reintroducing leopard frogs to the reservation. The plan was to collect egg masses, instead of tadpoles or adults, to avoid transporting disease or depleting source populations.

Genetic testing showed little variation among leopard frogs across the state, allowing biologists to use eastern Montana as a source. The scientists collected eggs in the Havre and Malta areas, and the Blackfeet, Assiniboine, and Gros Ventre tribes allowed them to gather eggs from breeding sites on their lands.

After collection, the eggs were flushed with clean water and transported back to the Flathead Reservation in insulated beverage coolers. But releases into a wetland near Pablo from 2003-06 failed to produce adult frogs. "We're not sure why," says Soukkala. "Spotted frogs overwinter in the area, but only a few leopard frogs survived." The team shifted focus to a large, recently restored wetland near Lonepine, on tribal lands set aside for wildlife habitat mitigation as part of the SKQ Dam (previously Kerr Dam) settlement. The wetland contains almost no standing water in late summer, preventing hungry fish from living there.

"It draws down over the summer," Soukkala says, "which is what you want for amphibian breeding. It stays wet long enough for the frogs to metamorph and then they head off because they're more of a grassland species. But it minimizes the threat of aquatic predator populations for the tadpoles and eggs."

The group also settled on a new method to give the frog larvae a head start—hatching eggs in tanks and letting them grow for a few days, in Werner's garage or Soukkala's basement. "Then you just dump them in," Soukkala says with a laugh.

Releases at the new site began in 2006 and continued through 2015. Within two years, frogs were overwintering. Within four, they were heard calling during the breeding season. Egg masses, confirming natural reproduction, were first found in 2013. Tadpoles were also released in several locations downstream, including some smaller wildlife habitat mitigation lands.

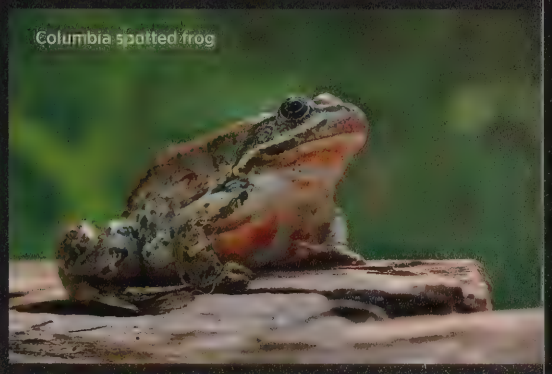
Then in 2017, CSKT fisheries specialist Cindy Bras-Benson brought a photo of a frog to work. Her father, Bud Bras, had found unfamiliar frogs hopping all over the tribal lands he leases for growing hay near Lonepine. When Bras-Benson showed Soukkala the picture, he was thrilled. It showed that northern leopard frogs were colonizing new areas three or four miles from the closest reintroduction site. "Kirwin

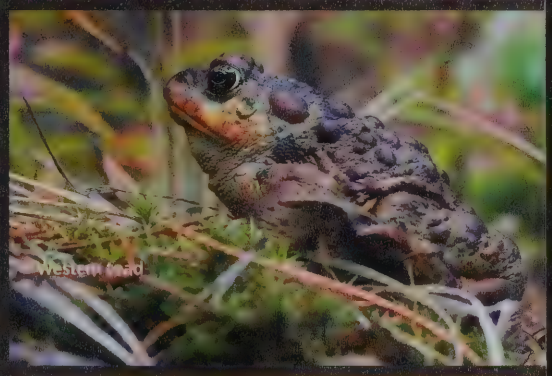
FROG MASTER Using a turkey baster, herpetologist Kirwin Werner counts tadpoles to determine egg hatching success and hatchling survival before releasing them into wetlands on the Flathead Indian Reservation.

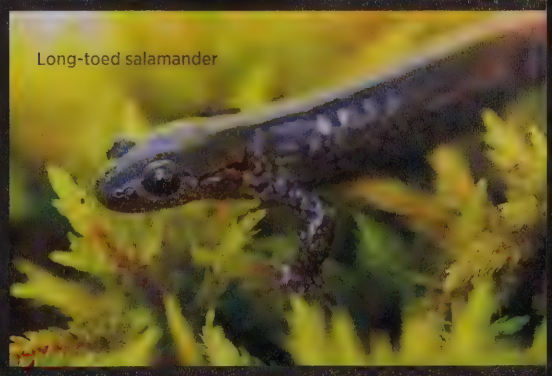
CLOCKWISE FROM TOP RIGHT: JEREMIE HOLLMAN; NATHAN COOPER; RANDY BEACHAM; JEREMIE HOLLMAN; ANDREW DUBOIS; ART SOUKKALA

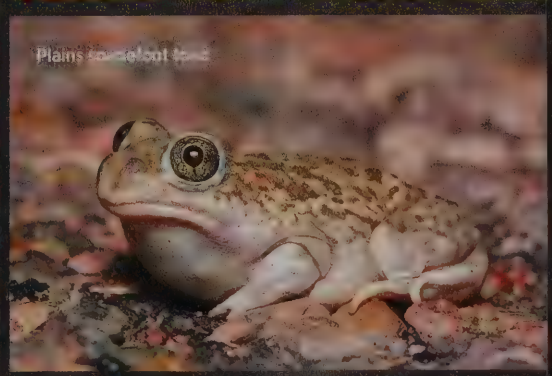
Montana amphibians

A few of the state's 13 native species









would have been thrilled too," Soukkala says, explaining that the herpetologist passed away in 2015, just as the leopard frog population was taking off.

Soukkala says he will continue monitoring the frogs' expansion from reintroduction sites and would like to begin another reintroduction elsewhere on the reservation. "At some point we hope to be able to use our own 'home-grown' eggs in addition to those we obtain from eastern Montana."

UPPER BITTERROOT PROJECT

Roughly 150 miles south of the Flathead Reservation, another amphibian project is under way. On an August morning, a small group of FWP employees and volunteers—including two hardy 12-year-olds—gathers along Overwhich Creek, in the West Fork drainage of the Bitterroot River. Ritter, the FWP biologist, and Alexis McEwan, assistant zoologist for the Montana Natural Heritage Program, are demonstrating the proper procedure for a kick-net survey. They drag their feet in the streambed, disturbing cobbles and upending rocks while holding large nets downstream to catch whatever floats free.

Amid the debris in her net, McEwan finds several dark, wriggling creatures, each with a long tail marked with a white spot. These are larvae, or tadpoles, of the Rocky Mountain tailed frog. The tadpoles use their suckerlike

mouth to cling to rocks in mountain streams, where they live and grow for about three years before undergoing metamorphosis.

The group is revisiting stream segments surveyed the previous year, following a project to remove non-native Yellowstone cutthroat trout above Overwhich Falls. In 2017, 2018, and 2019, roughly 10 miles of small streams above the falls were treated with rotenone, an organic toxicant that kills fish and other gill-breathing organisms.

"The primary goal was to remove a source of non-native cutthroat genes from the West Fork," says now-retired FWP fisheries biologist Chris Clancy, who planned the project with Mike Jakober, a Bitterroot National Forest fisheries biologist. Streams above Painted Rocks Reservoir but below Overwhich Falls contain genetically pure native westslope cutthroats, which are vulnerable to hybridization with Yellowstone cutts "dribbling over" the falls. Removing trout above the falls ends any genetic dilution.

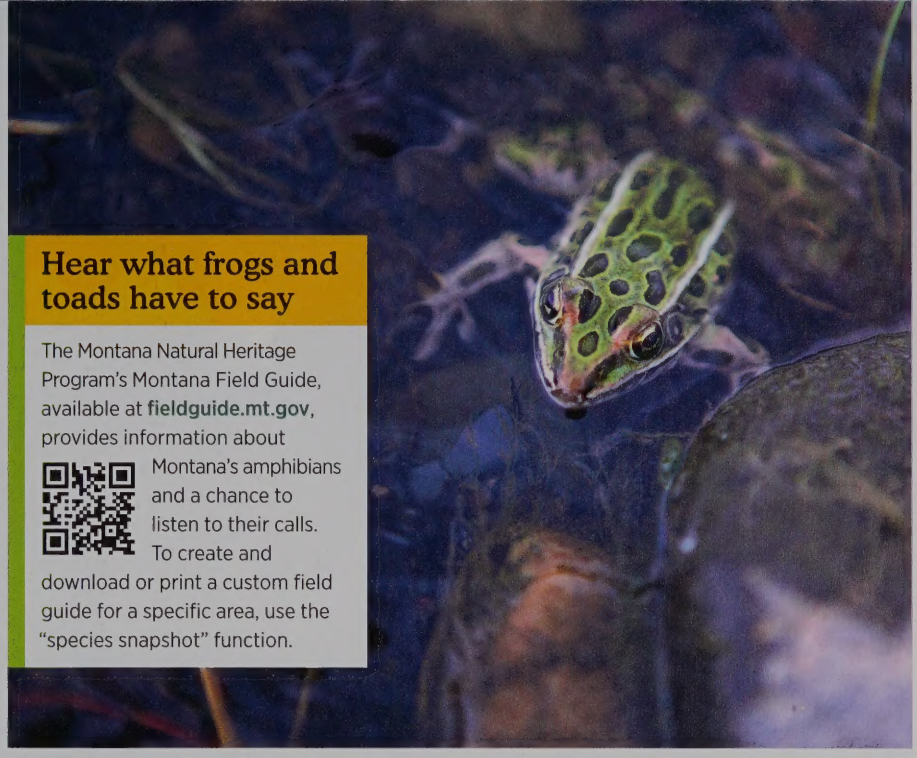
A SAFE PLACE

A secondary goal is to leave the streams above the falls fishless, as they were historically, to create a refuge for amphibians. The area is rich in tailed frogs, western toads, Columbia spotted frogs, and long-toed salamanders. Removing a non-native predator may help them flourish, and making these shallow, hard-to-reach streams fishless barely makes a dent in local angling opportunities. Upstream from Painted Rocks Reservoir, anglers can fish roughly 200 miles of streams containing westslope cutthroat trout.

The project does come with what Clancy calls a "short-term pain, long-term gain" for amphibians. Rotenone causes considerable mortality among tadpoles, though some manage to survive, likely by burrowing in the stream bottom. Ritter says the most recent tailed frog survey on several treated streams was encouraging, with decent numbers of both tadpoles and adults to help the population bounce back.

FINDING ROTENONE SURVIVORS Below left: One year after it was last treated with rotenone to remove non-native trout, surveyors on Overwhich Creek sort through debris in kick-nets looking for Rocky Mountain tailed frog tadpoles. Lower right: Buckets hold an adult tailed frog and several tadpoles, which were returned to the stream after identification. One goal of fish removal is to create a refuge for native amphibians.

PHOTOS: JULIE LUE; MAP: LUKE DURAN/*MONTANA OUTDOORS*



TOP TO BOTTOM: BECCA WOOD/ KRISTI DUBOIS

Hear what frogs and toads have to say

The Montana Natural Heritage Program's Montana Field Guide, available at **fieldguide.mt.gov**, provides information about Montana's amphibians and a chance to listen to their calls. To create and download or print a custom field guide for a specific area, use the "species snapshot" function.

Nongame biologists like Ritter work directly with individual species, including tailed frogs, black swifts, and great gray owls. But with the responsibility for managing hundreds of species, including amphibians, FWP's Nongame Wildlife Program is increasingly focusing on protecting varied habitats in larger landscapes, according to bureau chief Kristina Smucker. "That way you can help more than just one species at a time," she says. Among the many recent FWP habitat acquisitions or easements benefiting fish and wildlife including amphibians in western Montana:

- Lake Creek Conservation Easement north of Whitefish;
- North Shore Wildlife Management Area on Flathead Lake;
- a riparian restoration project on Spotted Dog WMA near Deer Lodge; and
- the Stumptown addition to Garrity WMA near Anaconda, which protects riparian habitat along Warm Springs Creek.

Even if a habitat project helps only a single frog species, with a frog's remarkably varied life history "it's like getting three or four species in one," Ritter says. "They start out as this little swimming, weird-looking alien thing with a round head and a tail, then they grow tiny little legs, then they turn into a frog with a tail, and then most turn into an adult tail-less amphibian. It's just an unbelievable transformation."

Yet as remarkable as Montana's native frogs are, Ritter adds, their sensitivity to pollutants, habitat loss, disease, and bullfrogs leaves them vulnerable to human development. "The CSKT and Overwhich Creek projects and the various habitat projects all show ways we might be able to mitigate that and help at least some of the frog species struggling to survive," he says.

BULLFROG BULLIES

In addition to risks posed by pollutants, habitat fragmentation, and disease, frogs face elimination by one of their own. Outside its home range in the eastern United States, the American bullfrog threatens many native bird, rodent, reptile, and amphibian populations, earning it a spot on the list of 100 worst invasive species in the world. Bullfrogs can now be found in 40 countries and nearly every U.S. state.

The aquatic invaders were likely introduced to Montana by people who wanted to hunt or raise them for food, or as unwanted pets released into the wild. (Note: Bullfrogs have been a prohibited species in Montana since 2005.) Populations are especially well-established in the Bitterroot Valley, along the lower Yellowstone River (particularly downstream from Laurel), and in parts of the lower Flathead River Basin, including Lonepine Reservoir, occupied by reintroduced northern leopard frogs.

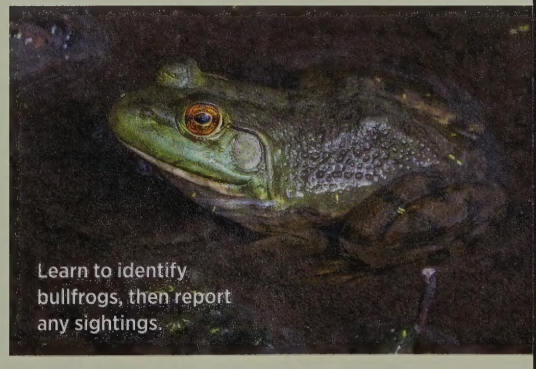
Large, prolific, and voracious, bullfrogs vacuum up anything they can fit in their super-sized mouth, including ducklings, small snakes, fish, rodents, other amphibians, and even bullfrogs smaller than themselves. They also can spread the chytrid fungus.

The Bitterroot Valley is especially hospitable to bullfrogs, says Bryce Maxell, program coordinator of the Montana Natural Heritage Program, because of the abundant artificial ponds built by homeowners. Many are bowl-shaped: deep and steep-sided. Though often designed for fish, they also provide habitat for bullfrogs, whose tadpoles need deep water for overwintering (in cold climates, they grow for two years or more before undergoing metamorphosis).

In contrast, saucer-shaped ponds—shallow, with gradual edges—favor native amphibians, many of which complete metamorphosis weeks or months after hatching.

Controlling bullfrogs may be extremely difficult in the Bitterroot and along parts of the Yellowstone, Maxell says. But habitat modification—turning bowl-shaped ponds into saucers—would help support native amphibians, as well as shorebirds and other bird species. Direct control efforts should be focused, he says, on new areas where bullfrogs are reported. "It's kind of like a wildfire. You want to put out embers that are falling."

Kristina Smucker, FWP's Nongame Wildlife Bureau chief, says the department has teamed up with the Montana Conservation Corps and Montana Department of Natural Resources & Conservation on a pilot project starting this summer that will test the effectiveness of different bullfrog eradication methods in western Montana. "We're also urging people to learn how to identify bullfrogs and then report sightings to their local FWP office," she says.



Learn to identify bullfrogs, then report any sightings.

Howdy, new neighbors!

By Tom Dickson

If you thought the droves of people moving to Montana in the 1990s and early 2000s were overwhelming, brace yourself.

Over the past year, it appears that out-of-staters have been pouring in. There's no hard data yet, but judging by the high number of nonresident license plates I saw this past winter, some kind of migration is taking place.

Another indicator is the current housing boom. A friend who co-owns a real estate company in Helena told me that in 40 years of selling homes, she's never seen anything like the current Treasure State home rush. "There's essentially no inventory in Helena right now; everything's sold out," she said. "And it's happening across Montana."

This time, blame Covid-19. The virus has made crowded urban areas seem less safe than spacious rural settings. Millions of one-time office employees also realize they can now work in their pajamas at the kitchen table with mountains out the window and trout streams down the road.

Who can blame them? Montana is blessed with abundant public land, great fishing and wildlife watching, endless trails, family-friendly state parks, and some of the prettiest rivers anywhere. Plus we have more breweries per capita than all but two states (Vermont and Maine). Talk about quality of life.

But Montana residents grumble when they see those California, Washington, and Texas vehicles driving around town. Who can blame *them*?

Yes, there's lots of open space, but start adding housing developments here, subdivisions there, and pretty soon we're looking like New Jersey with sagebrush. Also, many new residents don't seem to know the basic Montana rules, like that all our streams and rivers are open to public use.

Griping won't get us anywhere (I keep telling myself). People are moving here, like it or not. Maybe we could make this change work out for all of us.

So, to the newcomers, I say: Welcome! I know that many of you want to understand the Montana culture and not be seen as outsiders. You want to fit in, just as I did when I moved here 20 years ago. A few tips:

- Don't honk. It's a dead giveaway you're not from around here.
- In fact, impatience in general is frowned upon. That probably comes from realizing we can't hurry winter into spring or force a trout to take a fly it doesn't want.
- Montanans value undeveloped vistas. If you build a house, don't plop it atop a hill or bluff where it mars the landscape. Put it below the natural horizon. Better yet, keep it completely out of sight and enjoy your privacy.
- Also, don't build right next to a river or stream. No one wants leaky septic systems polluting Montana's treasured trout fisheries (which may be what attracted you here in the first place). You also don't want your living room under 2 feet of water during spring runoff.
- Consider learning how to hunt. It gets you outdoors and provides your family with organic, free-range meat. Not for you? Then at least learn a bit *about* hunting. It's a big part of the culture here.

And to my fellow Montanans, I say: Chill. Wanting to live here is not a crime. Most of us, or our parents or grandparents, were newcomers once. We learned Montana's unique, often-unspoken protocols, and all the recent arrivals can too.

That's why I propose providing each new resident with an "instructional" gift basket. Inside, with a jar of huckleberry jam, would be a can of bear pepper spray, a guide to driving in wet gumbo, a copy of the Montana Stream Access Law, a "Leave No Trace" pamphlet, a "Living with Grizzlies" brochure, and FWP's "Montana's Public Trust Responsibility" booklet.

For new ranch owners, the basket could also include a thumb drive containing the *Owning Eden* video that FWP and the Montana Stockgrowers Association produced several years ago. It explains how the privilege of owning ranchland comes with community responsibilities, like spraying weeds and allowing public hunting to control local elk numbers so the animals don't ravage the neighbors' hay fields and fencing.

Maybe add the names and contact information of the area FWP fisheries biologist, wildlife biologist, and game warden. That way, when questions arise, new landowners can learn how to leave some water in tributary streams for trout spawning, adjust fencing to accommodate wildlife migrations, and enroll in FWP's Block Management Program.

People are moving here for all the same reasons the rest of us stay here: abundant wildlife, clean water, great public access, and unobstructed views stretching for miles. Newcomers already know Montana is awesome. Let's help them understand what Montanans do to keep it that way.

Tom Dickson is the editor of Montana Outdoors.

Pygmy nuthatch

Sitta pygmaea

By Julie Lue

Beetles attacked the aspen tree outside our window, drilling into its heart and leaving piles of debris, like crumbles of shredded-wheat cereal, around its base. After the tree died, my husband and I meant to cut it down. But procrastination and a dull saw left it standing until the next spring, when a family of pygmy nuthatches spent several weeks excavating a nest cavity in the rotten trunk.

Three years later, my family and I still often wake on spring and summer mornings to what sounds like a dozen squeaky toys being compressed at once. Excited twittering greets adult nuthatches as they begin delivering breakfast to their young in the old aspen, which they have weatherproofed by jamming dog fur in the cracks. Each adult stuffs a weevil down a tiny gullet, then flits off to nearby ponderosas in search of more food.

APPEARANCE

The pygmy nuthatch is a small, rounded bird about 4 inches long, with plush feathers in subtle colors. It has a bluish-gray back; grayish-brown cap; cream to buff or grayish throat and breast; and a sharp, straight bill that is mostly black in adults but partly yellow in juveniles. The smallest of Montana's three nuthatch species, the pygmy lacks the black hood of the white-breasted nuthatch and the vivid eye stripe and orange-washed breast of the red-breasted nuthatch.

Julie Lue is a writer in Florence.

SOUND

Pygmy nuthatches most commonly communicate with a high, staccato piping, aptly described by the Cornell Lab of Ornithology's allaboutbirds.org site as "rubber-ducky calls."

HABITAT

In Montana, pygmy nuthatches live in ponderosa pine forests in western and southern parts of the state. They can also be found from southern British Columbia to central Mexico in other areas of long-needled pines. For nesting, they need mature trees, usually pines, either dead or with dead sections they can hollow out. They will use nest boxes when suitable trees aren't available.

FEEDING

Pygmy nuthatches sort through the needles and bark of pine trees in their hunt for weevils, beetles, and spiders. They also eat pine seeds, which they cache by jamming them into bark. Thanks to a strong back toe and claw on each foot, pygmy nuthatches climb straight up or down a tree trunk or even spiral around it. They may be seen foraging right-side up, upside down, or sideways.

BREEDING

Unusual for songbirds, pygmy nuthatches are cooperative nesters. About a third of nests are attended by "helpers," usually uncles or older male siblings of the current brood, that pitch in to excavate the nest cavity, deliver food to the nesting female, and feed chicks.

SCIENTIFIC NAME *Sitta* is Greek for "nuthatch," and *pygmaea* is derived from the Latin word for "small" or "dwarf."

Pygmy nuthatches raise one or two broods a season. The female lays five to nine eggs, which hatch after about two weeks. The chicks leave the nest two to three weeks later, sometimes before they can fly. They climb up and down the nest tree, occasionally stranding themselves on a branch and needing a parental tug on the tail feathers to get unstuck.

WINTER SURVIVAL

Social as always, a pygmy nuthatch family will join other groups after the breeding season to form large flocks. Communal roosting helps them survive cold winters. They crowd into tree cavities in groups of up to 150—sometimes to the point where birds die of suffocation.

CONSERVATION

The bird conservation organization Partners in Flight ranks the pygmy nuthatch as a species of low conservation concern. But because the bird's fate is linked to that of mature ponderosa pine forests, it is considered an indicator species, and in several states (though not Montana), a species of "special concern." In areas where trees are logged, retaining adequate numbers of standing dead or dying trees ("snags") is key to maintaining healthy pygmy nuthatch populations.

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BOULDER POINT LOOKOUT IN THE SELWAY-BITTERROOT WILDERNESS. PHOTO BY AARON THEISEN

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